Apple Technician Guide

MacBook Pro (17-inch, Early 2009)

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MacBook Pro (17-inch, Early 2009)

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Apple Technician Guide introduced 13 February 2009

Apple Technician Guide

Basic

MacBook Pro (17-inch, Early 2009)

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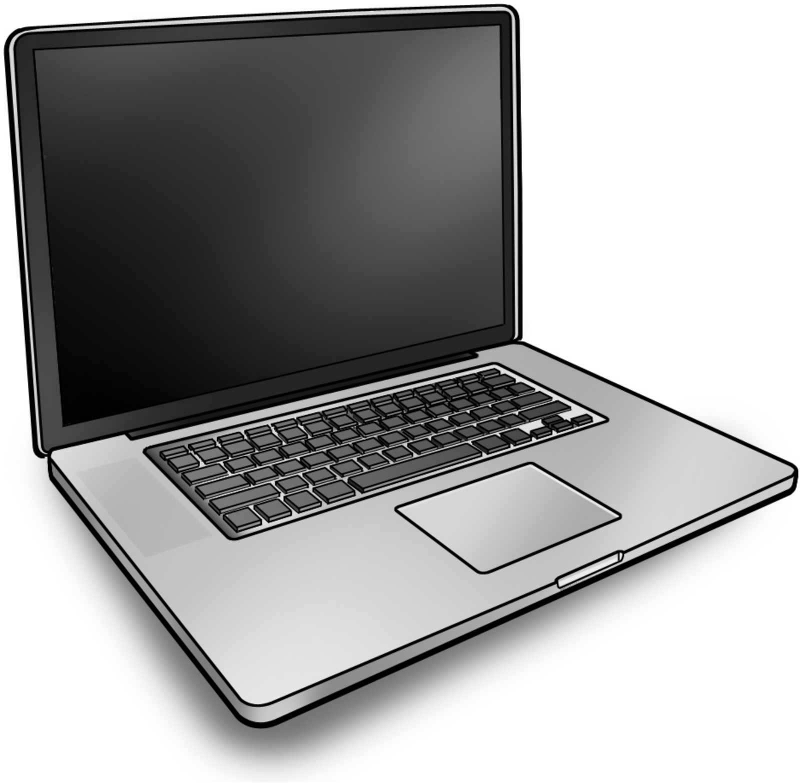
Overview



The MacBook Pro (17-inch, Early 2009) computer features both the NVIDIA GeForce 9400M integrated graphics processor and a high-performance NVIDIA 9600M GT graphics processor, Multi-Touch trackpad, and aluminum body. Refer to more features below.

Identifying Features

The main features and service differences include:

- Aluminum unibody enclosure, machined from a single piece of aluminum
- Ultrathin 17-inch LED-backlit glossy display, 1920 by 1200 pixels
- Mini DisplayPort connector and three high-powered USB 2.0 ports
- Express Card slot, 34mm
- Battery indicator button on left side

- Product identification label is etched on bottom case near hinge
- Logic board, MagSafe board, and some other components have a uniform black color with no component silkscreening.

Product Configurations

The following table shows the MacBook Pro (17-inch, Early 2009) model configurations at introduction:

Feature	Standard (MB604)	Optional (Z0G5)
Intel Core 2 Duo processor	2.66 GHz	2.93 GHz
Memory, DDR3 1066, SO-DIMMs	4 GB (2 x 2 GB); up to 8 GB (2 x 4 GB)	4 GB (2 x 2 GB); up to 8 GB (2 x 4 GB)
Hard Drive, Serial ATA	320 GB, 5400 rpm	320 GB, 7200 rpm; or 128 GB or 256 GB solid state
Optical Drive (SATA)	8x DL Super, 9.5 mm	8x DL Super, 9.5 mm
Housing	Aluminum unibody	
Display, 17-inch glass LCD, 1920x1200, 114 dpi, LED backlight	wide-screen glossy	wide-screen glossy or anti-glare
I/O	• USB: 3- USB 2.0 (high powered) • FireWire: 1-FW800 • Video I/O: Mini Display Port • Audio I/O: Combo digital.analog in, Combo digital/analog/iPhone headset out, Microphone, Stereo speakers with subwoofer • Camera: Wave 4 camera (f2.4, 3 micron pixel (640x480)) • Other: IR, Battery Indicator Light, 34mm Express card	
Battery	95 WHr lithium polymer	
Power Adapter	85 W MagSafe	

Note About Images in This Manual

Because a pre-production model was used for most of the images shown in this manual, you may notice small differences in appearance between the image pictured and the computer you are servicing. However, although the appearance may differ, the steps and sequence are the same unless noted.

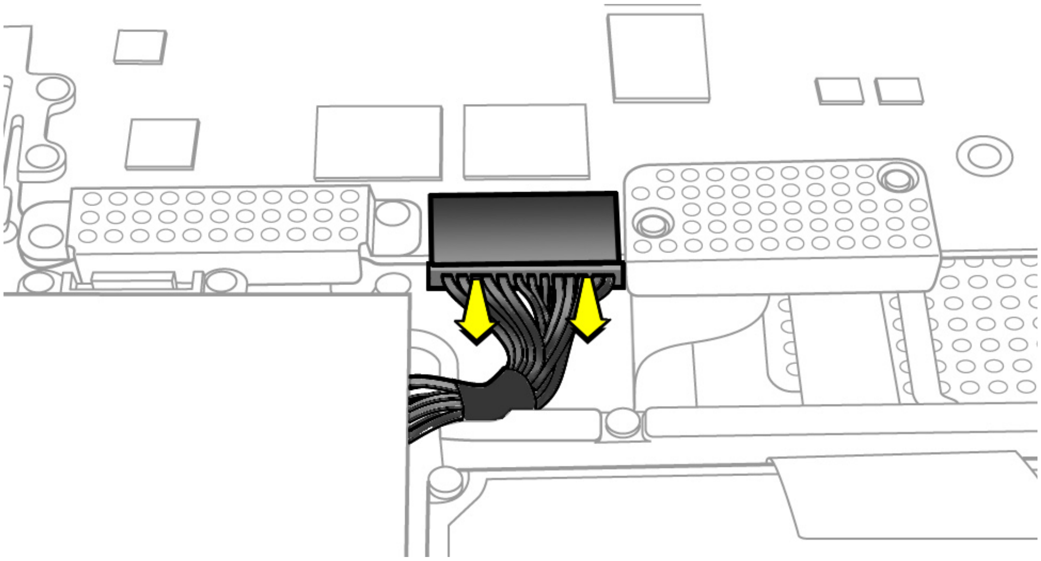
Screw sizes shown are approximate and indicate the total length including the screw head.

Battery Precautions

This computer contains an internal-only battery that is serviceable by Apple-authorized service providers only. Tamper-proof screws are employed to prevent customers from attempting to remove it.

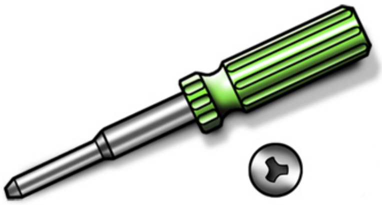
WARNING: Every time you remove the bottom case, disconnect the battery cable from the logic board.

WARNING: Because the battery is internal and connected to the logic board by a cable, it **MUST BE DISCONNECTED** before performing service procedures. If you fail to do so, live current from the battery will short circuit the components and render the logic board and/or LVDS cable unusable.



Battery Removal: Tri-Lobe Screws

Battery screws may be removed with a tri-lobe screwdriver. If that tool is unavailable, a 3/32 (2.3-mm) flat head jeweler's screwdriver may be used.

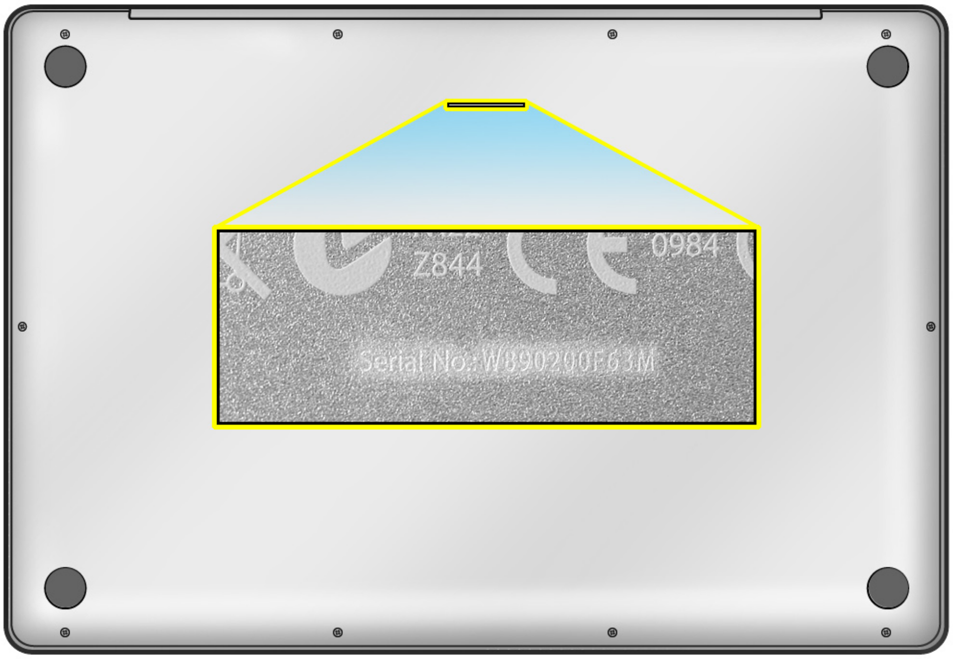


Important: The **only** time the battery should be removed is when replacing either of these:
- battery
- top case

Serial Number Location

Serial Number On Bottom Case

Turn over the computer to see the serial number etched on the bottom case near the hinge.

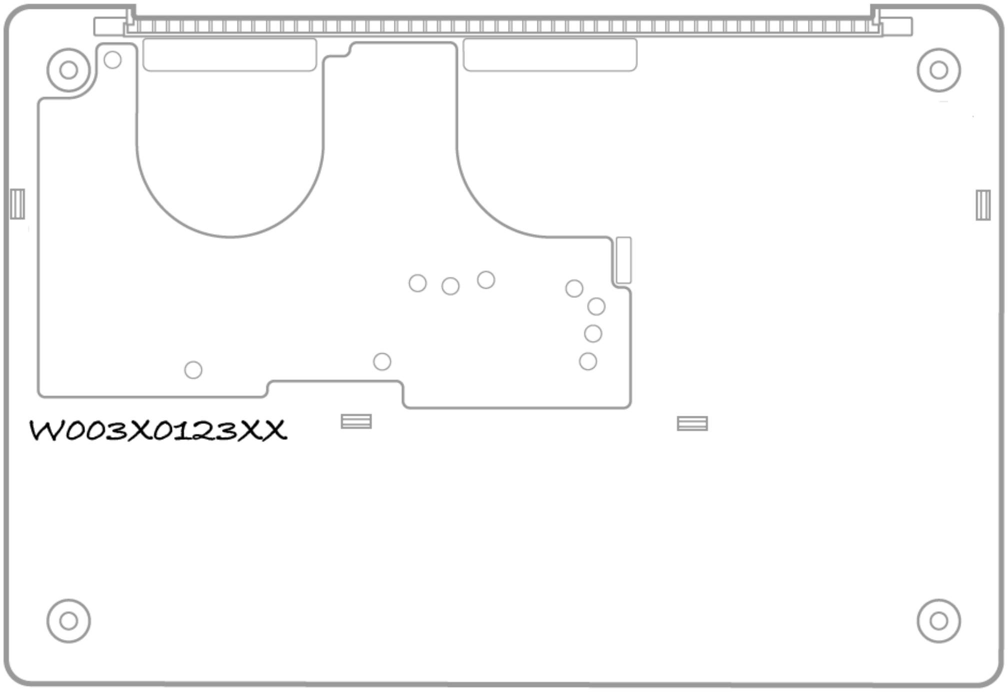


Z844
0984
Serial No.: W890200F63M

Transferring the Serial Number

When replacing a bottom case, retain the customer's bottom case until the repair is complete. Before installing the replacement bottom case, use a fine tip permanent marker to write the original serial number clearly and legibly in uppercase box letters directly onto the inside of the new bottom case.

CAUTION: Take great care in deciphering the small typeface of the etched serial number on the bottom case. You might need a magnifying glass to see it clearly. It is imperative that you transfer the correct alphanumeric characters. Keep in mind that Apple serial numbers always use the numbers 1 and 0 instead of the Roman letters "I" and "O."



General Information

Required Tools

Caution: To prevent scratches or other cosmetic damage to the computer housing, use a soft cloth as a protective layer when removing and installing the external screws.

The following tools are required to service the computer:
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #0 screwdriver
- Magnetic Phillips #00 screwdriver (preferably with a long handle)
- Torx T6 screwdriver
- Tri-lobe screwdriver or 3/32 (2.3-mm) flat blade jeweler's screwdriver
- Black stick (Apple probe tool, part number 922-5065) or other nonconductive nylon or plastic flatblade tool
- EMI-safe plastic or nylon tweezers for installing flex cables (optional)
- Thermal grease (Apple thermal compound syringe, part number 922-8991)
- Alcohol wipes
- Permanent marking, felt-tip pen
- Pencil with eraser
- Foam wedge fixture for display assembly removal (Apple part number 922-8779)
- Kapton tape
- Tweezers, ESD safe, extra fine points, for flat cable replacement
- Magnifying glass, for reading serial number etched on bottom case
- Digital volt meter (troubleshooting)

Refer to Knowledge Base article "Hand Tools for Desktop and Portable Repairs--AP/CA/EU/JP/LA/US" to purchase tools:

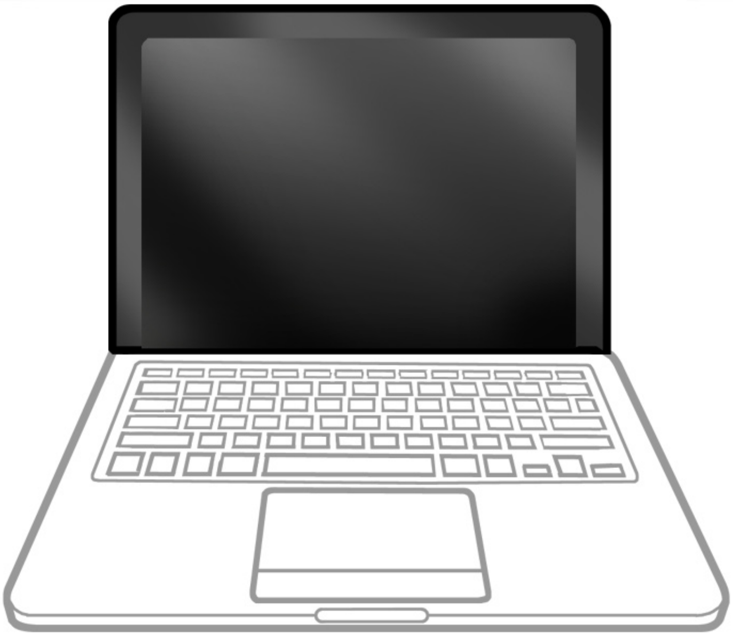
http://docs.info.apple.com/article.html?artnum=500200

In addition, the following software programs are required for troubleshooting:
- Apple Service Diagnostic (ASD), version 3S128 or later
- Apple Hardware Test, version 3A148 or later

The Glass Panel

Warning: The glass panel for this model is not a serviceable part. If the glass is broken or scratched, replace the display assembly. Attempting to remove the glass can permanently shatter the display face and damage other parts.

To clean the glass panel, use the Apple polishing cloth (922-8245) and iKlear Apple Polish or Brillianize anti-static spray cleaning solution. Alternatively, IPA (isopropyl alcohol) can be used.



Apple Technician Guide

Troubleshooting

MacBook Pro (17-inch, Early 2009)

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General Troubleshooting

Update System Software

Important: Whenever possible before beginning troubleshooting, ensure the latest software and firmware updates have been applied.

Apple Service Diagnostics

Run Apple Service Diagnostic to determine if any of the thermal sensors are malfunctioning. Replace any failing sensors. See chart below for correlation between error code and part.

Name	Location
TC0D	Logic Board
TC0P	Logic Board
TG0D	Logic Board
TG0H	Logic Board
TG0P	Logic Board
TG0T	Logic Board
TG1H	Heatsink
Th2H	Logic Board
TN0D	Logic Board
TN0P	Logic Board
Tm0P	Logic Board
Ts0P	Trackpad flex

Test Points

There is no silkscreen text on final production logic boards. Test points mentioned in troubleshooting charts are solely for reference.

Troubleshooting Theory

For general information on troubleshooting theory, go to GSX and find the Service Training course menu link. From there you can access the Troubleshooting Theory self-paced course,

Hardware vs. Software

For information on how to isolate a hardware issue from a software issue, refer to:

http://support.apple.com/kb/TS1388?viewlocale=en_US

TS1394—Mac OS X: Troubleshooting installation and software updates <http://support.apple.com/kb/TS1394>

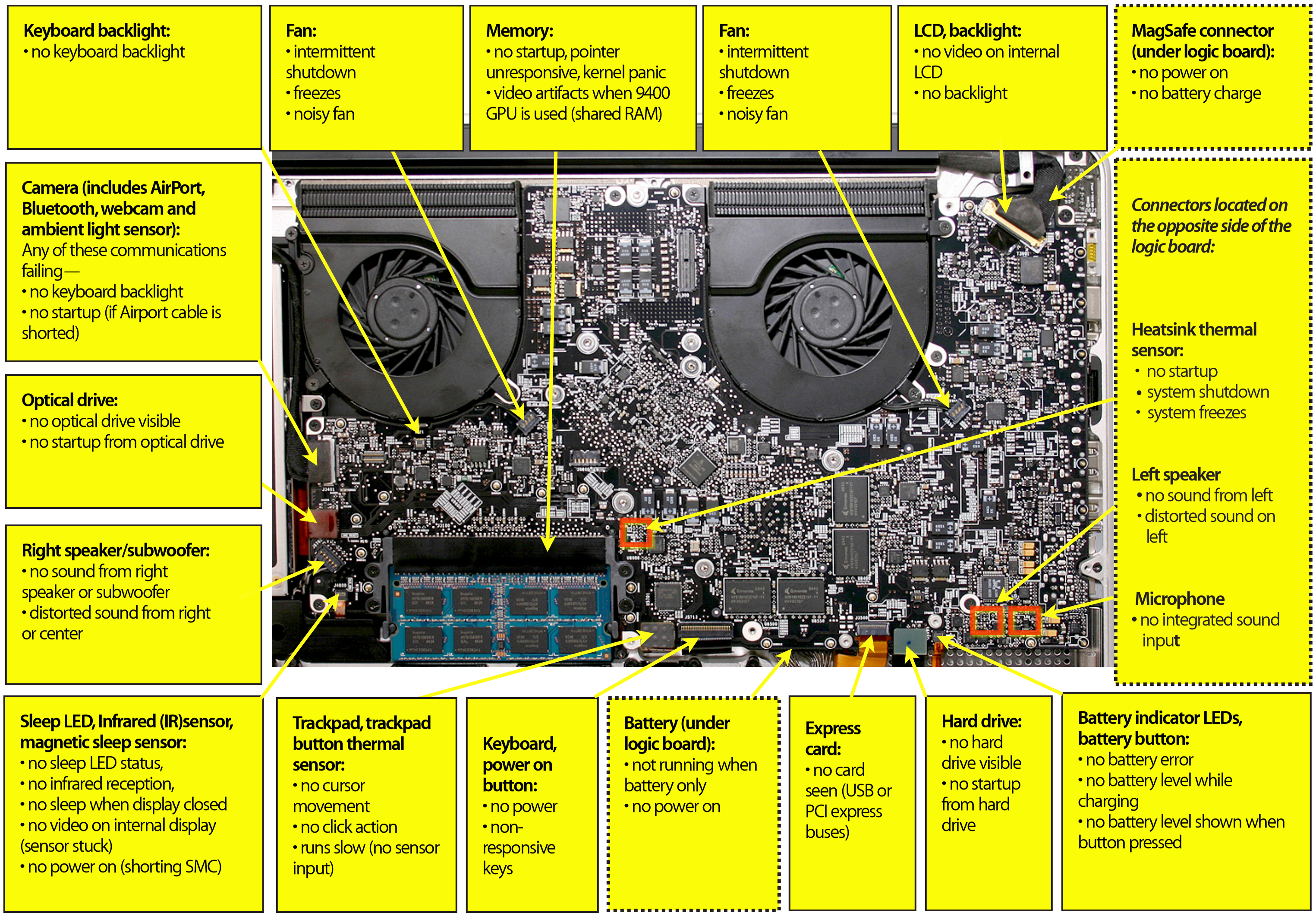
HT2956—Troubleshooting Mac OS X installation from CD or DVD <http://support.apple.com/kb/HT2956>

For information on how to troubleshoot a software issue, refer to:

HT1199—Mac OS X: How to troubleshoot a software issue <http://support.apple.com/kb/HT1199>

Functional Overview

Refer to this diagram for symptoms related to MacBook Pro (17-inch, Early 2009) logic board connectors.



Keyboard backlight:
- no keyboard backlight

Fan:
- intermittent shutdown
- freezes
- noisy fan

Memory:
- no startup, pointer unresponsive, kernel panic
- video artifacts when 9400 GPU is used (shared RAM)

Fan:
- intermittent shutdown
- freezes
- noisy fan

LCD, backlight:
- no video on internal LCD
- no backlight

MagSafe connector (under logic board):
- no power on
- no battery charge

Camera (includes AirPort, Bluetooth, webcam and ambient light sensor):
Any of these communications failing—
- no keyboard backlight
- no startup (if Airport cable is shorted)

Optical drive:
- no optical drive visible
- no startup from optical drive

Right speaker/subwoofer:
- no sound from right speaker or subwoofer
- distorted sound from right or center

Connectors located on the opposite side of the logic board:

Heatsink thermal sensor:
- no startup
- system shutdown
- system freezes

Left speaker
- no sound from left
- distorted sound on left

Microphone
- no integrated sound input

Sleep LED, Infrared (IR)sensor, magnetic sleep sensor:
- no sleep LED status,
- no infrared reception,
- no sleep when display closed
- no video on internal display (sensor stuck)
- no power on (shorting SMC)

Trackpad, trackpad button thermal sensor:
- no cursor movement
- no click action
- runs slow (no sensor input)

Keyboard, power on button:
- no power
- non-responsive keys

Battery (under logic board):
- not running when battery only
- no power on

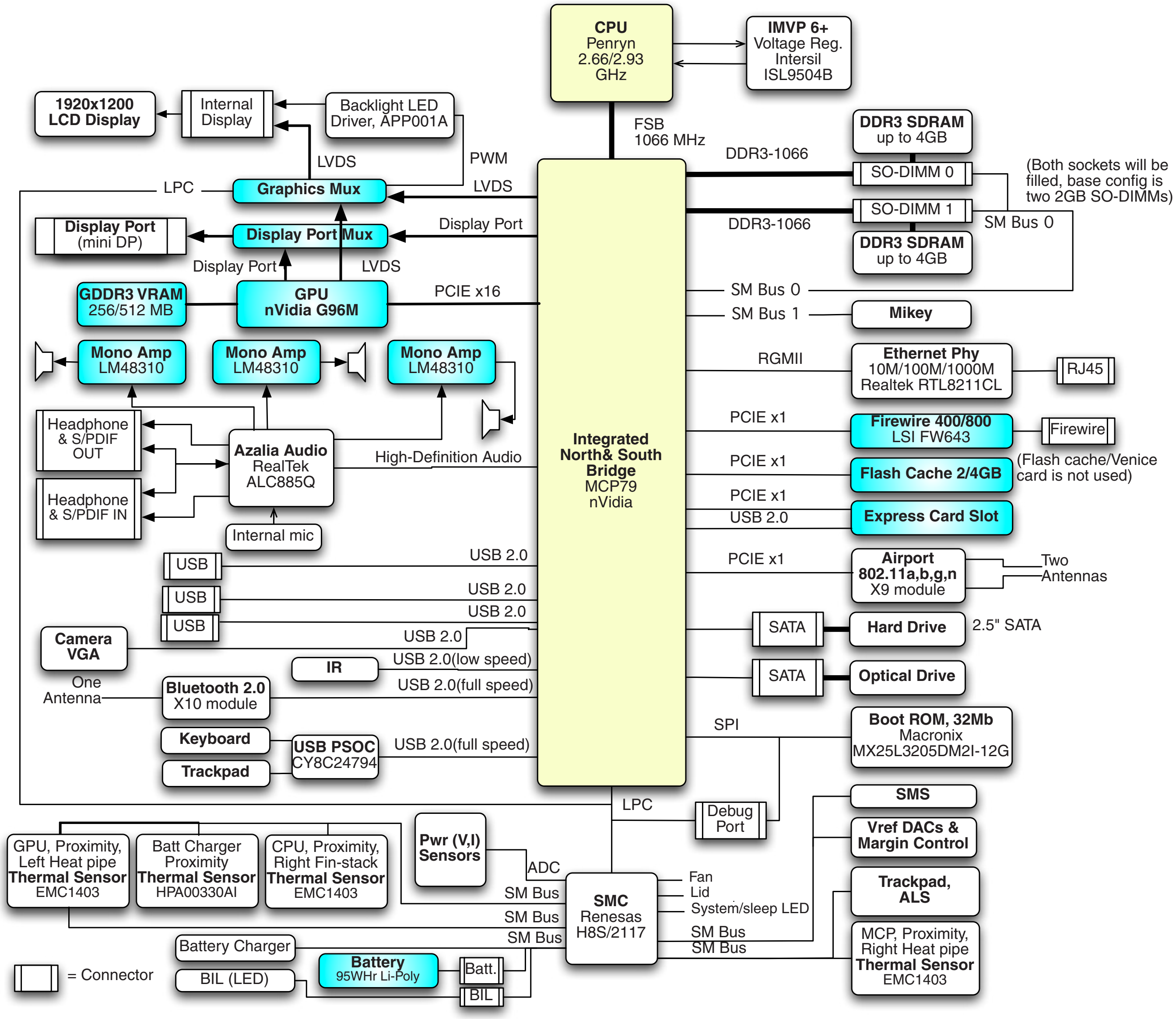
Express card:
- no card seen (USB or PCI express buses)

Hard drive:
- no hard drive visible
- no startup from hard drive

Battery indicator LEDs, battery button:
- no battery error
- no battery level while charging
- no battery level shown when button pressed

Block Diagram: MacBook Pro (17-inch, Early 2009)

Refer to this diagram to see how modules are interrelated.



CPU
Penryn
2.66/2.93
GHz
IMVP 6+
Voltage Reg.
Intersil
ISL9504B
FSB
1066 MHz
1920x1200
LCD Display
Internal
Display
Backlight LED
Driver, APP001A
PWM
LVDS
LPC
Graphics Mux
LVDS
DDR3-1066
DDR3 SDRAM
up to 4GB
SO-DIMM 0
SO-DIMM 1
(Both sockets will be
filled, base config is
two 2GB SO-DIMMs)
Display Port
(mini DP)
Display Port Mux
Display Port
DDR3-1066
SM Bus 0
DDR3 SDRAM
up to 4GB
Display Port
LVDS
GDDR3 VRAM
256/512 MB
GPU
nVidia G96M
PCIE x16
SM Bus 0
SM Bus 1
Mikey
Mono Amp
LM48310
Mono Amp
LM48310
Mono Amp
LM48310
RGMII
Ethernet Phy
10M/100M/1000M
Realtek RTL8211CL
RJ45
Headphone
& S/PDIF
OUT
Azalia Audio
RealTek
ALC885Q
High-Definition Audio
Integrated
North& South
Bridge
MCP79
nVidia
PCIE x1
Firewire 400/800
LSI FW643
Firewire
PCIE x1
Flash Cache 2/4GB
(Flash cache/Venice
card is not used)
Headphone
& S/PDIF IN
Internal mic
PCIE x1
USB 2.0
Express Card Slot
USB
USB 2.0
PCIE x1
Airport
802.11a,b,g,n
X9 module
Two
Antennas
USB
USB 2.0
USB
USB 2.0
SATA
Hard Drive
2.5" SATA
Camera
VGA
USB 2.0
IR
USB 2.0(low speed)
SATA
Optical Drive
One
Antenna
Bluetooth 2.0
X10 module
USB 2.0(full speed)
SPI
Boot ROM, 32Mb
Macronix
MX25L3205DM2I-12G
Keyboard
USB PSOC
CY8C24794
USB 2.0(full speed)
Trackpad
LPC
Debug
Port
SMS
Vref DACs &
Margin Control
GPU, Proximity,
Left Heat pipe
Thermal Sensor
EMC1403
Batt Charger
Proximity
Thermal Sensor
HPA00330AI
CPU, Proximity,
Right Fin-stack
Thermal Sensor
EMC1403
Pwr (V,I)
Sensors
ADC
SM Bus
SMC
Renesas
H8S/2117
Fan
Lid
System/sleep LED
Trackpad,
ALS
SM Bus
SM Bus
SM Bus
SM Bus
Battery Charger
MCP, Proximity,
Right Heat pipe
Thermal Sensor
EMC1403
= Connector
BIL (LED)
Battery
95WHr Li-Poly
Batt.
BIL

Common Reset Procedures

When a reset procedure is required for troubleshooting, follow the applicable steps:

Resetting the System Management Controller (SMC)

To reset power management via the SMC chip:

1. If the computer is on, turn it off.
2. Disconnect the power adapter and remove the main battery.
3. Hold the power button down for five seconds, then release.
4. Install the main battery and connect the power adapter.
5. Press the power button to restart the computer.

Resetting the SMC means you will also need to reset the date and time (using the Date & Time pane of System Preferences).

For more information:

http://www.apple.com/support

HT1411—Apple Portables: Resetting the System Management Controller (SMC) <http://support.apple.com/kb/HT1411>

Resetting the Parameter RAM (PRAM)

To reset PRAM,

1. If the computer is on, turn it off.
2. Locate the following keys on the keyboard: Command, Option, P, and R. You will need to hold these keys down simultaneously in Step 4.

   Note: If the keyboard does not have an Option key, use the Alt key instead.
3. Turn on the computer.
4. Press and hold the Command-Option-P-R keys.

   Important: You must press this key combination before the gray screen appears.
5. Hold the keys down until the computer restarts and you hear the startup sound for the second time.
6. Release the keys.

For more information:

http://www.apple.com/support

HT1379—Apple Portables: Resetting the PRAM <http://support.apple.com/kb/HT1379>

Starting Up in Safe Mode

A Safe Boot is a special way to start Mac OS X when troubleshooting. To start up into Safe Mode (Safe Boot),

1. Make sure the computer is shut down.
2. Press the power button.
3. Immediately after you hear the startup tone, press and hold the Shift key.

   Note: The Shift key should be held as soon as possible after the startup tone but not before.

4. Release the Shift key when you see the screen with the gray Apple and progress indicator (looks like a spinning gear). During startup, "Safe Boot" appears on the Mac OS X startup screen. To leave Safe Mode, restart the computer normally, without holding down any keys during startup.

For more information:

http://www.apple.com/support

HT1564—What is Safe Boot, Safe Mode? <http://support.apple.com/kb/HT1564>

TS1884—Safe Boot take longer than normal startup <http://support.apple.com/kb/TS1884>

Display Issue: Pixel Anomalies

When displaying a single color over the screen area, the LCD panel might show one or more pixels that are not properly lit. To determine if the display has an acceptable number of pixel anomalies, follow the steps below:

1. Set the display image to one of the following colors: all-white, all-red, all-green, all-blue, or all-black display. Knowledge Base article 112125: "Service Diagnostics Matrix", has the LCD Tester Diagnostic Utility that will generate these patterns on the screen.
2. Using a jeweler's loupe, pocket microscope, or other magnifying device, identify and count each pixel anomaly:

   Bright subpixel anomaly = subpixel that is always on

   Dark subpixel anomaly = subpixel that is always off

3. The number of acceptable pixel anomalies for this computer is:

Bright	Up to 4
Dark	Up to 6
Combination	Up to 8

4. If the number of subpixel anomalies exceeds the acceptable number shown above, replace the LCD panel display assembly. Numbers outside the acceptable range would be

Bright	5 or more
Dark	7 or more
Combination	9 or more

5. If the number of subpixel anomalies is acceptable, explain to the customer that the pixel anomalies are within specifications, and no repair is necessary.

Important: Do not release the specifications to customers. Instead, inform them that a certain number of subpixel anomalies are considered acceptable, and these factors apply to all manufacturers using LCD technology—not just Apple products.

When speaking with customers, please use the following explanation:

> Active-matrix LCD technology uses rows and columns of addressable locations (pixels) that render text and images on screen. Each pixel location has three separate subpixels (red, green, and blue) that allow the image to be rendered in full color. Each subpixel has a corresponding transistor responsible for turning the subpixel on or off.
>
> There are typically millions of these subpixels on an LCD display. For example, the LCD panel used in the Apple Cinema HD display is made up of 2.3 million pixels and 6.9 million red, green, and blue subpixels. Occasionally, a transistor does not work perfectly, which may result in the affected subpixel being turned on (bright) or turned off (dark). With the millions of subpixels on a display, it is quite possible to have a low number of faulty transistors on an LCD. Therefore, a certain number of subpixel anomalies are considered acceptable. Rejecting all but perfect LCD panels would significantly increase the retail price for products using LCD displays. These factors apply to all manufacturers using LCD technology—not just Apple products.

Symptom Charts

Follow the steps in the order indicated below. If an action resolves the issue, retest the system to verify. **Note**: A compilation of Quick Check tables is available at **http://service.info.apple.com/QRS/en/quickreference.pdf.**

Note: There is no silkscreen text on final production logic boards. The photos shown with test points are from pre-production units and are solely for reference.

Startup and Power Issues

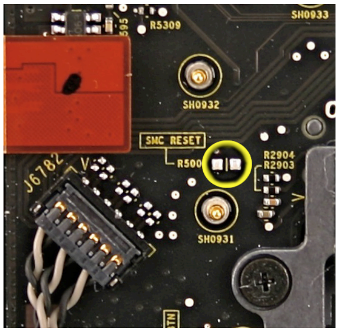
No Power

Unlikely cause: display assembly, speakers, optical drive, hard drive

Quick Check

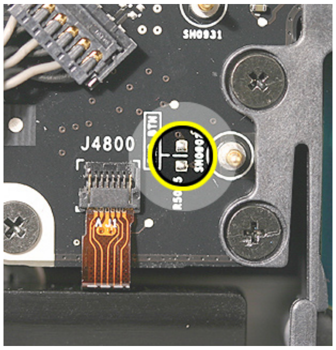
Symptom	Quick Check
No Power / Dead Unit • No power • No image • No startup chime • No fan or hard drive spin • No reset sound from optical drive • No sleep LED activity • No light if Caps Lock pressed • Non-operational	**1.** Verify AC power presence with MagSafe LED indicating on or charge state. **2.** Verify battery status as being partly charged, charging with AC power. **3.** Reset SMC. **4.** Refer to Deep Dive table for battery diagnostic testing.

Deep Dive



Check	Result	Action	Code
1. Isolate peripherals as cause. Disconnect all peripherals and external devices and verify unit starts.	Yes	Suspect peripherals as cause. Reconnect each one at a time, verifying unit operation as external device is reinstalled.	
	No	Go to step 2	
2. Reset SMC, and verify unit starts. (Alternative hardware SMC reset can be forced by shorting R5001 pads on logic board or removing all system power for 1 minute.) Can system start up after SMC reset?	Yes	Corrupt SMC state preventing power on. Issue resolved with SMC reset.	
	No	Go to step 3	
3. Will system power up with battery only? Check battery level LED indicator for status of battery charge or battery use error. Inspect battery connector for burn marks or damaged pins if substituting a known-good battery to verify starting on battery.	Yes	System can start up from known-good battery -- customer battery possibly at fault or needs to be charged. Continue to verify customer battery then AC adapter use and battery charging. Go to step 4.	**P11**
	No	System will not power using known-good battery only. Go to step 5	
4. Customer battery may be run down, or not recognized. Verify customer battery in a known-good system is recognized and accepting a charge. Confirm customer battery is not consumed nor defective.	Yes	Battery is recognized, charging and health is good. Return to test unit with customer battery and AC adapter power. Go to step 6.	
	No	Replace customer battery for not charging (P10) or not recognized (P11). Customer to purchase a replacement battery if consumed.	**P10** or **P11**
5. Inspect battery cable connection at logic board and reseat if necessary. Replace cable if found damage or burned. Can the system power on from a charged battery with battery cable inspections or replacement?	Yes	Battery power restored, return to test unit with customer battery and AC adapter power. Go to step 6.	
	No	Logic board is expected to power on with battery only. Inspect and test power on key. Go to step 10.	

6. Inspect MagSafe power adapter. Verify AC adapter is correct wattage, compatible with product and works on known-good computer.	Yes	Power adapter is good, go to step 7	
	No	Release stuck pin or replace adapter due to wire damage, not working or burned pins	**P14**
7. Inspect MagSafe port on computer for physical damage, debris or metal fragments attracted to magnetic connector. Is MagSafe connector clean and free from defects?	Yes	Go to step 8	
	No	Clean port assembly. Replace MagSafe board if necessary.	**X03**
8. Verify adapter status LED turns on green then orange indicating power and battery charge in progress. A green LED can indicate a full battery, removal of battery or battery not recognized.	Yes	System starts and has power. MagSafe LED indicates power is flowing to logic board. Verify customer battery will also charge. Review battery health to ensure customer satisfaction.	**P11**
	No	AC power is down or battery is not charging. Go to step 9	
9. Verify power from adapter is present on logic board. Remove system battery, use AC power only. Reseat or test known-good MagSafe cable to achieve power for logic board.	Yes	Logic board has power adapter energy to start system. MagSafe cable reseat or replacement resolved issue. If still no system power on indications, go to step 10	**X03**
	No	AC adapter power not going to logic board power supplies. Replace logic board.	**M21**
10. Test and inspect Top Case Power Button. Stuck or open power on key or keyboard disconnect can disable the power on of system. If button does not work, locate pads R5015 on logic board just to right of IR/sleep cable. Short pads to power up logic board. If power on key is stuck, keyboard cable must be disconnected for R5015 to work. Does system power on? (Reconnect keyboard cable to confirm bad or intermittent connections.)	Yes	Power on key works fine, issue resolved.	
		Power on key works when keyboard cable is reseated.	
		Power on key appears to be stuck, had to remove keyboard cable to power on. Replace top case for stuck power on key	**K05**
	No	No logic board power on when shorting R5015 pads. Replace logic board.	**M01**



Won’t Start Up

Unlikely cause: display assembly, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Power but No start up • No startup chime, some video activity, Apple logo, startup spin dial • Startup chime with possible beep tones. • Fan, hard drive spin or optical drive reset sound • Sleep LED is on , blinking or went out • Caps Lock LED toggles when pressed	**1.** Reset SMC. **2.** Verify startup process passes initial memory checks – no beep errors or flashing sleep LED indicators. Display activity is starting up. **3.** Clear PRAM. Verify starts up from user drive. **4.** Connect known-good external bootable device and press Alt key during startup then select external startup device to bring up system for diagnostics. **5.** Verify presence and status of user hard drive. Use Disk Utility to repair drive and file permissions.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and Clear PRAM to set default startup device to internal hard disk drive (HDD).	Yes	User hard drive bootable, issue resolved default settings.	
	No	Customer system not starting up, go to step 2	
2. Is system indicating a memory error with repeated sleep LED 1 or 3 flash sequence and beep tones if sound is enabled?	Yes	Troubleshoot memory issues, go to step 3	
	No	Continue with startup sequence verification go to step 4	

3. Reseat customer memory and/or swap in known-good memory to isolate bad memory and replace defective parts.	Yes	Customer memory defective and replaced. Continue to verify startup process. Go to step 4	**X02**
	No	Should known-good memory fail in one or more slots, replace logic board.	**M07**
4. Hold the Alt (Option) key during startup and verify there is a bootable hard drive shown in Startup Manager. Choose customer hard drive. Does start up from this drive work?	Yes	System starting up from customer hard drive. Startup issue resolved	
	No	Customer hard drive not present or does not start up from this drive. Continue to find bootable device. Go to step 5	
5. Insert product OS install disc in optical drive. Install disc is bootable and should be present in Startup Manager. Can system start up from OS install disc?	Yes	Starts up from optical drive - customer hard drive not yet bootable, go to step 8	
	No	Computer has no internal bootable devices. Test external startup devices, go to step 6	
6. Boot from a known-good bootable copy of product OS on a USB drive or network server to start up and verify internal mass storage devices are available using System Profiler and Disk Utility.	Yes	System started up from external device and reports data regarding internal SATA devices. Go to step 7	
	No	No startup devices available. Replace logic board	**M02**
7. Troubleshoot optical drive and optical drive cable with cable reseat and known-good part substitutions. Is there a defective optical drive component to replace?	Yes	Cable reseat solved issue. Continue to verify hard drive issues, go to step 8	
		Defective optical drive cable found and replaced. Continue to verify hard drive issues, go to step 8	**X03**
		Defective optical drive found and replaced. Continue to verify hard drive issues, go to step 8	**J03**
	No	Replace logic board	**M19**

8. Use Disk Utility loaded from OS install disc to verify if hard drive is available on device list. Is customer hard drive listed in Disk Utility?	Yes	Customer hard drive available for inspections and repair. Go to step 10.	
	No	Hard drive not present, troubleshoot hard drive and cable. Go to step 9.	
9. Troubleshoot hard drive and hard drive SATA cable with cable reseat and known-good part substitutions. If customer hard drive, is there a defective hard drive component to replace?	Yes	Reseat of SATA cable now has customer hard drive visible in Disk Utility, go to step 10	
		Defective hard drive SATA cable found and replaced, now has customer hard drive visible in Disk Utility, go to step 10	**X03**
		Suspect customer hard drive defective, attempt OS restore, go to step 10	
	No	Known-good hard drive and known-good hard drive SATA cable used, still no hard drive present. Replace logic board	**M19**
10. Boot system with Shift key down. Does it work?	Yes	Go to software troubleshooting article	
	No	Go to step 11	
11. Use Disk Utility to repair customer hard drive and repair permissions if system OS found on hard drive. Is hard drive bootable after software repairs?	Yes	OS on customer hard drive repaired, issue resolved.	
	No	Hard drive not bootable, perhaps missing OS, go to step 12	
12. Use Disk Utility to partition customer hard drive with one GUID partition then restore Mac OS from product OS install disc. Is hard drive bootable after OS install?	Yes	Customer hard drive now starts up from new OS image, issue resolved	
	No	Replace hard drive.	**H02**

Intermittent Shutdown

Unlikely cause: hard drive, optical drive

Quick Check

Symptom	Quick Check
Intermittent shutdown • Powers off during startup • Powers off with desktop use	**1.** Verify battery charge status **2.** Check AC adapter MagSafe connector and connection with system **3.** Reset SMC and PRAM **4.** Start up with shift key down for safe mode **5.** Startup from known-good bootable device **6.** Check system.log info for shutdown cause **7.** Run AHT /ASD for sensors + thermal test

Deep Dive

Check	Result	Action	Code
1. Identify shutdown code recorded in system log file. Open the system.log file with console application. Search for occurrences of "previous shutdown cause" return codes. Verify system log looking for codes that indicate abnormal shutdown events.	Yes	-Intermittent power means checking battery health , AC source and MagSafe cable seating ; go to step 4 -Sleep means running sleep sensor test; go to step 7 -Overtemp means checking for clogged heatsink, shorted sensors cables or defective fan; go to step 8	
	No	system.log lists only normal shutdown codes, no codes related to heat sensors or power concerns. Go to step 2	

2. Reset SMC and clear PRAM; then monitor system performance to verify if system shutdowns cease. Are shutdown symptoms and events gone?	Yes	Shutdown cause related to SMC or PRAM resolved by changing to default settings.	
	No	Shutdown event still occurs. Go to step 3.	
3. Start up from product OS install disc or from an external hard drive with product Mac OS. Are shutdown symptoms and events gone while starting up from this known-good Mac OS?	Yes	Shutdown events cease on known-good OS. Reinstall Mac OS on customer hard drive and update OS with latest version and check if bootROM updates are available.	
	No	Symptoms unchanged - go to step 4	
4. Check system running on battery only. Use known-good charged battery. Verify that shutdown/reset/sleep issues disappear when known-good battery is used without AC adapter.	Yes	Recharge customer battery and retest. Check for customer battery health in Apple System Profiler or run battery testing utility, and replace if reported battery health is reported bad or consumed.	**P09**
	No	Symptoms unchanged - Go to step 5	
5. Check with known-good AC adapter source only Remove battery and use known-good AC adapter. Does the shutdown/reset/sleep issue disappear with known-good adapter?	Yes	Faulty adapter. Replace customer AC adapter if AC cable and duckhead were confirmed faulty.	**P14**
	No	Symptoms unchanged - Go to step 6	
6. Check if power removed error reported "improper shutdown detected" in system.log If shutdown error is related to power removed shutdown cause, run ASD and check for overvoltage sensor failure reported.	Yes	If voltage or current sensor failure confirmed in ASD w/known good DC and batteries, replace logic board.	**MO8**
	No	Go to step 9	

7. Check if sleep event happens repeatedly in system.log If sleep/wake events are repeatedly reported, plug external monitor and run ASD to check for sleep sensor test. Verify if sleep sensor test is failing.	Yes	Check for intermittently shorted sleep sensor in top case. If damaged, replace sensor/cable of top case.	**X03**
		Check IR cable is properly seated	**X03**
		Reseat and retest sleep sensor with ASD. If failing again, check for presence of magnet in display assembly above sensor.	**X03**
		If magnet present, replace sensor/cable or top case and retest. If still sleep sensing failing, replace logic board	**M22**
		if magnet missing replace display assembly	**L15**
	No	Go to step 8	
8. Check if over temp cause reported in system.log If shutdown error is related to over temp shutdown cause, run ASD and verify that a sensor or fan failure is reported.	Yes	-If fan not running failure, check for fan cable seating and retest. If same failure after retest replace fan with known-good fan and retest. If does not happen with known-good fan, replace fan.	**M18**
		-If over temp failure reported check for cause of over temp like obstructed vent, dust in heatsink fin, or clogged fan and retest. If still failing replace part where sensor is located (logic board, battery, display assembly or trackpad) according to the sensor location table of service manual. Go to step 9	**X03**
	No	Replace Thermal module Go to step 9	**X10**

9. Isolate if issue solved Verify that shutdown/issue does not happen anymore after part exchange.	Yes	Issue fixed	
	No	Replace logic board with corresponding symptom: -if for thermal error cause -if for other cause	**M18** **M08**

No Video/Bad Video

Unlikely cause: hard drive, optical drive, top case, battery, power adapter

Quick Check

Symptom	**Quick Check**
Power, but No Video • Power • No video • fan, hard drive spin, or optical drive reset sound • sleep LED is on or went on • light if Caps Lock pressed	**1.** Reset SMC. **2.** Reset PRAM. **3.** If no startup chime, verify with known-good memory. **4.** Verify with external monitor. **5.** Press Alt key on startup..

Deep Dive

Check	**Result**	**Action**	**Code**
1. Characterize video issue Define whether the issue is a bad image with backlight OR no video issue. Verify whether some image even distorted is visible.	Yes	Bad image quality, go to step 5	
	No	No image seen or no backlight, go to Step 2	
2. Isolate Peripherals as cause Disconnect all peripherals, external devices, Express Card and display adapters if present and verify that video is displayed.	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage	
	No	Go to Step 3	

3. Adjust Brightness Power-on unit , attempt to adjust brightness to maximum using brightness (F1/F2) keys and verify that video is displayed.	Yes	Video displayed - Brightness set to minimum, panel backlight was inadvertently turned off. If backlight returns to low check for stuck F1 key on keyboard.	
	No	Go to Step 4	
4. Reset SMC Reset SMC and verify that system video is displayed.	Yes	Corrupt SMC State preventing video.	
	No	Go to Step 5	
5. Reset PRAM. If no action, use external keyboard with same sequence. Verify that system video is displayed.	Yes	Invalid or Corrupt PRAM contents affecting video output	
	No	Go to step 6	
6. Connect External video Connect known-good VGA/DVI adapter to known-good display, press power button and close display to force main screen startup on external video. Verify that video is correct when displayed from external display.	Yes	Video correct on external display. Research available firmware and software updates, retest. If returning with software already updated, go to Step 7	
	No	Reseat LVDS cable on logic board then retest. If symptom unchanged replace logic board with according symptom code: -no video -bad/distorted video	**M03** **M04**

7. Isolate LCD display detection Disconnect external monitor and reopen display and restart unit. Verify that sleep LED indicator goes off after internal LCD has been detected.	Yes	Sleep LED goes off when LCD detected. -If still no video then Go to step 8, -If video present, but with defect, go to step 9	
	No	Internal LCD not detected. Reseat LVDS cable connection on logic board and retest. If sleep led does not go off after cable is reseated, go to step 10	
8. Check for sleep sensor condition If display assembly sleep sensor is stuck in a closed state, video will appear on internal display temporarily, until the OS sleeps the system. Disconnect IR/sleep cable and restart unit without external display. Verify that system starts up with video on internal display stays on and does not go into sleep mode.	Yes	Sleep sensor was stuck or had shorted cable. Replace IR/sleep cable (or enclosing top case)	**X13**
	No	Symptoms unchanged - Go to Step 9	
9. Check for No Backlight Condition. Power on unit. Verify Apple logo lights up on top case.	Yes	Logo image visible - check and reseat LED backlight cable connector on logic board (below right fan). Inspect cables for damage near clutches: . if damaged, replace display assembly and go to step 11 . if cable is not damaged, reseat it and retest, then go to step 11	**L09**
	No	If symptom continues, go to step 10.	

10. Verify with Known good display assembly Connect known-good display assembly to system.	Yes	System is functioning with known-good display assembly Replace display assembly if following symptom reporting: - had no power issue - had incorrect/missing colors - had blank video - had distorted / blurred video - had vertical/horizontal lines - had noise/unstable flickering - had dim backlight - had bad spot(s)/pixels - had no backlight - could not change resolution	**L01** **L02** **L03** **L04** **L05** **L06** **L07** **L08** **L09** **L10**
	No	Symptoms unchanged - replace logic board	**M03**
11. Verify with reseated backlight cable or replaced display assembly Verify that unit now has video and backlight.	Yes	Issue was only due to damaged display assembly or unseated cable.	
	No	Display cable damaged the logic board. Replace logic board.	**M25**

Battery Isn't Recognized or Won't Charge

Unlikely cause: display assembly, speakers, optical drive, hard drive, trackpad

Quick Check

Symptom	**Quick Check**
Battery isn't recognized or won't charge • AC adapter • No MagSafe LED indicator • No orange charge indication • Battery status LEDs: - single chase - all flash - no LED	**1.** Check battery level and test AC power. **2.** Refer to Deep Dive table for battery diagnostic testing.

Deep Dive

Check	Result	Action	Code
1. Does the MagSafe LED go green to amber when connected to the system?	Yes	Battery is recognized and charging. Go to step 6	
	No	LED is green, Battery may be full or not recognized. Go to step 2	
		LED was on momentarily then went out. Go to No Power for system (M01)	
2. When the Battery status button is pressed, did any of the lights come on?	Yes	Go to step 3	
	No	Go to step 11	
3. Does battery status indicate a fully charge battery with all LEDs on?	Yes	Customer battery charged, check health. Go to step 13.	
	No	Go to step 4	
4. Does battery status indicate the battery is not recognized with a single LED on that chases back and forth 5 times?	Yes	Go to step 8 and tag battery as a possible P11 candidate.	**(P11)**
	No	Go to step 5	
5. Does battery status indicate the battery is recognized but not charging with all LEDs blinking?	Yes	Go to step 8 and tag battery as a possible P10 candidate	**(P10)**
	No	Go to step 6	
6. Does battery status indicate battery charge and flash the next level 5 times?	Yes	Customer battery charging, check battery condition. Go to step 13	
	No	Flashing first LED only, go to step 7	
		No battery status LEDs on, go to step 11	
7. Does battery status indicate a low battery with a LED flashing rapidly indicating initial charging of battery?	Yes	Allow customer battery to charge to 1 LED on before checking battery condition. Go to step 13.	
	No	Go to step 8	

8. Test with a known-good battery. Is battery recognized and charging?	Yes	Replace customer battery (P10 not charging or P11 not recognized)	**P10 or P11**
	No	Go to step 9	
9. Inspect customer battery battery cable connector for corrosion or obstructions.	Yes	Clear obstructions and replace battery if corroded and recheck. (P10 not charging or P11 not recognized)	**P10 or P11**
	No	Go to step 10	
10. Reseat battery harness at logic board connector, and retest. Is battery recognized and charging?	Yes	Issue resolved by cable reseat. Check battery condition, go to step 13	
	No	Replace logic board	**M20**
11. Battery status LEDs not working - inspect button stuck or cable disconnect at logic board and reset SMC.	Yes	LED status now working. Go to step 3.	
	No	Go to step 12.	
12. Remove system battery and connect and test a known-good battery status indicator assembly. Do LEDs indicate a battery not recognized chase pattern?	Yes	Replace customer battery LED indicator assembly. Go to step 3	**X03**
	No	Replace customer logic board.	**M20**
13. Open Apple System Profiler and click on the Power Tab on the left. Is the battery over 300 cycle counts?	Yes	Battery has been consumed, and customer will need to purchase a replacement.	
	No	Go to step 14.	
14. Is battery less than a year old?	Yes	Go to step 16	
	No	Battery warranty expired, go to step 15	

15. Considering the age of the battery greater than one year old, is the health of the battery "Good" according to system profiler?	Yes	Battery is in good health and out of 1 year warranty coverage. Battery should continue to function until consumed.	
	No	Battery is consumed after warranty coverage. Customer to purchase a new battery.	
16. For batteries still covered by warranty, is the health of the battery "Good?"	Yes	Battery functioning normal. Go to step 17.	
	No	Battery has premature capacity loss. Replace customer battery.	**P08**
17. With battery charge greater than 20% does battery support system operation without AC connected?	Yes	Customer battery is good	
	No	Go to step 18	
18. Test with a known-good battery. Does known-good battery support battery only operation?	Yes	Replace customer battery for will not run system on battery alone	**P12**
	No	Replace logic board	**M20**

Kernel Panic/System Crashes

Unlikely cause: Battery, Power Adapter

Quick Check

Symptom	**Quick Check**
Memory Issues/Kernel panic and freezes • Display notice of system kernel panic during start up and desktop use. • System freeze during use. • System freeze upon wake from sleep.	**1.** Reset SMC and clear PRAM **2.** Remove suspect external devices. **3.** Verify user memory is Apple-approved memory, and memory configuration matches memory installed. **4.** Start up with shift key down for safe mode. **5.** Startup from known-good bootable device **6.** Check panic.log info for crash cause **7.** Run AHT for sensors test

Deep Dive

Check	Result	Action	Code
1. Isolate Peripherals as cause. Disconnect all peripherals, external devices, and display adapters if present	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage	
	No	Go to Step 2	
2. Reset SMC and clear PRAM then verify that unit starts without panic issues.	Yes	Issue resolved with default startup settings.	
	No	Go to step 3	
3. Boot in Safe Mode with Shift key down, and check for recent kernel panic data in panic log. Open Panic.log file on hard drive and check for affected interface that crashed. If unit still crashes during startup, you will need to take out disk to a good system to access the file. Verify that kernel panic dependency is not with an I/O interface.	Yes	Kernel Panic is not a system I/O related device. Go to step 5	
	No	I/O device related crash, go to step 4	

4. Remove I/O device where possible to pinpoint faulty device: - Disconnect camera cable from display assembly (for AirPort, Bluetooth, camera, and ambient light sensor). Camera cable can be disconnected without affecting startup and test. - Bluetooth card to isolate Bluetooth. - optical drive cable to isolate optical drive. - hard drive cable to isolate hard drive. Memory cards can be removed, relocated, or tested with known-good memory. Because system will run on one card, this is a useful test for finding bad memory or bad memory slot. If issue remains after testing I/O device, replace with known-good part(s) to confirm issue resolved.	Yes	System starts up when I/O device removed, replace affected I/O device or module containing it. If AirPort card presence is crashing system, replace AirPort card. If still issue, replace display assembly (for Bluetooth, camera, or cable damage). If Bluetooth card presence is crashing system, replace Bluetooth. If issue remains, replace display assembly for damaged Bluetooth (camera) cable. If optical drive presence is crashing system, replace optical drive cable and retest. If issue remains try with known-good optical drive. If still issue, replace optical drive. If hard drive presence is crashing system, replace hard drive cable and retest. If issue remains, try with known-good hard drive. If still issue, replace hard drive. Reseat memory or replace suspect memory with known-good memory.	**N13** **L14** **N15 or** **L16** **X03** **J03** **X03** **H01** **X01**
	No	Symptoms unchanged, go to step 5	
5. Start up from optical drive or known-good OS. Attempt to start up with original or product install disc, or from an external hard drive with product OS installed, and verify that system starts without kernal panic.	Yes	Kernel panics cease running alternate OS. Run ASD/ DiskUtility to repair and test hard drive. If repair attempts fail, repartition hard drive and reinstall OS. Replace hard drive if restore fails.	**H03**
	No	Symptoms unchanged, go to Step 6	

6. Disconnect display assembly and test with known-good display assembly. Verify that system now starts up without kernel panic/freeze.	Yes	Replace display assembly.	**L14**
	No	Go to step 7	
7. Check for thermal values and fan running speed Run ASD to check for fan and sensors test, and verify that ASD does not report any overtemp, failing sensor, or fan.	Yes	No thermal fail detected - Replace logic board with matching symptom: - If hang or freeze - If Kernel Panic/system crashes	 **M05** **M06**
	No	If sensor test failed, reseat sensor connections on logic board and retest. If still failing, replace sensor or part where it is located (top case, display, other) : If top case sensor failed If display sensor failed If logic board sensor failed If fan test failed, replace fan. If overtemp , replace heatsink.	 **X99** **L14** **M18** **X03** **X10**

Battery Run Time Too Short

Quick Check

Symptom	Quick Check
Battery Run Time Too Short Battery runs out of power very quickly (less than two hours)	**1.** Check if the battery is covered under a repair extension program. Use the "Portable Computer Battery Screening Process for Apple Service Providers" (**Knowledge Base CP165**). **2.** Verify no applications have runaway processes with the CPU. See "Runaway applications can shorten battery runtime" (**Knowedge Base TS1473**). **3.** Run battery diagnostic testing..

Won’t Run on Power Adapter Alone

Unlikely cause: RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

Quick Check

Symptom	Quick Check
Won’t Run on Power Adapter Alone Runs on battery but not on power adapter only.	**1.** Verify proper wattage adapter is being used. **2.** Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer. **3.** Connect the AC adapter to known-good power source. **4.** Verify power cord or plug is properly attached to AC adapter and MagSafe cable is not damaged.

Deep Dive

Check	Result	Action	Code
1. With battery removed, will a known-good AC adapter start up and run the system and show MagSafe LED status?	Yes	Confirm user’s AC adapter as bad and replace.	**P14**
	No	Verify MagSafe board cable seating to logic board. Go to step 2	
2. Does a known-good power adapter’s LED light up either green or amber?	Yes	SMC on logic board senses AC power adapter. Go to step 3	
	No	Replace the MagSafe board. Go to step 3.	
3. Does the unit run on known-good power adapter alone?	Yes	Issued resolved.	**X03**
	No	Replace logic board..	**M01**

Power Adapter Issue

Unlikely cause: logic board, RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

Quick Check

Symptom	Quick Check
Power Adapter Issue • No power • No Power LED • Non-operational • Stuck /broken pin	**1.** Connect AC adapters MagSafe connector to the computer. The LED on the connector should be green or amber. **2.** Verify power cord, or plug, is firmly attached to AC adapter. **3.** Verify AC power source is supplying AC power. **4.** Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer. Use and cleaning of power adapter with MagSafe

Deep Dive

Check	Result	Action	Code
1. Verify that the MagSafe LED is green or amber while connecting a known-good AC adapter on customer system.	Yes	SMC on logic board senses AC power adapter and enabled power. Go to step 4.	
	No	Verify MagSafe interconnect board is connected to logic board. Go to step 2	
2. Does the unit run on known-good AC power adapter only?	Yes	Issued resolved.	**P99**
	No	Replace the MagSafe interconnect board. Go to step 3.	
3. Verify the MagSafe LED is green or amber while connecting known-good power adapter on customer system.	Yes	Bad MagSafe interconnect board. Issue resolved.	**X03**
	No	Go to step 4	
4. Does the customer's power adapter have stuck or bent pins on the MagSafe connector?	Yes	Replace power adapter.	**P15**
	No	Go to step 5	

5. Does the cable or duckhead have visible damage?	Yes	Replace cable or duckhead.	**P16**
	No	Go to step 6	
6. Check that LED on MagSafe connector is displaying both green (if battery charged) and orange (when charging).	Yes	Verify adapter with known-good unit and customer unit and troubleshoot source of error	
	No	Replace power adapter.	**P03**

Noise / Hum / Vibration

Unlikely cause: RAM, display assembly, top case, camera, microphone, battery

Quick Check

Symptom	**Quick Check**
Noise / Hum / Vibration Computer or AC adapter emits a noise or vibration.	**1.** Verify and reproduce the source of the noise from the computer / adapter with the customer. **2.** If the AC adapter is the source of the noise disconnect and try a known-good adapter. (a small amount of hum or vibration is normal with AC adapters).

Deep Dive

Check	**Result**	**Action**	**Code**
1. Use of a known-good AC adapter eliminates the noise/ vibration.	Yes	Replace AC adapter.	**P04**
	No	Go to step 2	
2. Verify if the noise is heard through the speakers and / or headphones.	Yes	Go to step 3	
	No	Go to step 4	
3. Disconnect any peripheral devices, cards, or cables attached to the unit. Verify the noise is gone.	Yes	Check for possible ground loop.	
	No	Go to step 6	

4. Locate the source of the noise. Is the noise from an optical drive?	Yes	Check with a different media disc. Possible issue with disc label or out of balance media. If not related to media, and noise is above normal level, replace optical drive.	**J04**
	No	Go to step 5	
5. Is the noise from the hard drive?	Yes	It is normal for drives to produce noise when they spin up or the heads move. Replace drive if noise is above normal levels.	**H06**
	No	Go to step 6	
6. Is the noise coming from the fan?	Yes	The fan(s) are generally running in a slow mode, but may accelerated when intensive processing is required (calculation, 3D gaming, or screen saver animation). If still beyond expected sound level, check for interference of fan with other mechanical element of system (foam, bracket, shield) before replacing a noisy fan.	**X03**
	No	Go to step 7.	**P04**
7. Noise maybe related to interference from other electrical devices operating near the computer, or on the same AC power source. Verify if noise is gone when operating in a different location on a different AC circuit.	Yes	Perhaps operating the unit with a surge suppressor will eliminate or reduce the noise. Change location of use or limit use of other device that is inducing the noise.	
	No	Replace logic board.	**M99**

Burnt Smell / Odor

Unlikely cause: Enclosure

Quick Check

Symptom	Quick Check
Burnt Smell / Odor Computer or power adapter emits an odor or smell of smoke.	**1.** Disconnect AC adapter from the computer. **2.** Attempt to identify the source of the odor. Visual clues are component damaged like capacitor chip popped or burn marks.

Deep Dive

Check	Result	Action	Code
1. Has the source of the odor been identified.	Yes	Replace the affected part.	**P08**
	No	Go to step 2	
2. Are any burn marks visible on components?	Yes	Remove display assembly and clutch cover. Is AirPort Card cable correctly oriented and connected? If so, replace the affected part. If not, reseat the cable correctly and replace the logic board.	**P08**
	No	Go to step 3	
3. Is the computer operating normally?	Yes	This could be related to normal operation.	
	No	Please refer to best related troubleshooting section. If after inspecting the unit you feel there is a possible safety issue with the computer or AC adapter, please notify Apple.	

Battery Leaking or Swollen

Quick Check

Symptom	Quick Check
Battery Leaking or Swollen - Computer wobbles - Trackpad button does not work - Deformed bottom case	**1.** Check if the battery is covered under a repair extension program. Reference: MacBook, MacBook Pro (15-inch) or MacBook Pro (17-inch) with swollen battery article (**Knowledge Base TS2358**). **2.** Use the "Portable Computer Battery Screening Process for Apple Service Providers" (**Knowledge Base CP165**) and use "Battery pack is visibly deformed" case under section 2E. Use symptom code **P13**.

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the customer. If not, document reported symptom and send feedback to **smfeedback@apple.com** stating that a suitable symptom code could not be found.

Communications

Ethernet Port/Device Issue

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case, display assembly, AirPort card

Quick Check

Symptom	Quick Check
Ethernet Port/Device Issue • No Ethernet device present • Unable to access network resources • Ethernet device shows no connection • Ethernet device unable to get an IP address • Slow network performance	**1.** Check the network cable for damage, try a known good Ethernet cable – CAT5 or better recommended for 100Mbps+ connections. **2.** Check Ethernet ports on Mac and wall/switch for dust, debris, damage or bent pins. **3.** Ensure distance from networking infrastructure is less than 300 feet / 105 meters. **4.** Verify port, cable and network hardware with a known good system. Isolate firewall, MAC address filtering or hardware access control devices. **5.** Check system logs. Isolate OS by starting up from original install media (10.5.x) or compatible known good OS.

Deep Dive

Check	Result	Action	Code
1. Visually inspect Ethernet connector to ensure all pins will make physical contact with CAT5 network cable.	Yes	Ethernet interface contacts are good. Go to step 2.	
	No	Pins are damaged or bent flat, replace logic board.	**M10**

2. Isolate OS by booting from original install media. Verify Network Link status active by using Network Utility on install DVD. If the Ethernet interface (en0) Link Status is inactive, recheck physical connect and link activity indicator on hub/switch.	Yes	Ethernet interface (en0) Link Status is active, go to step 3.	
	No	If connection is OK on known-good system, replace logic board.	**M10**
3. Verify if IP address is listed for the Ethernet interface in System Preferences: Network. Connect computer to network with known-good DHCP IP allocation, ensuring static DHCP maps or filtering is not preventing address allocation. Note: DHCP allocation may not be instantaneous depending on network. Retest.	Yes	Go to step 4.	
	No	If connection is OK on known-good system, replace logic board.	**M10**
4. Verify connection by using Network Utility to ping another connected computer on the same subnet. Ensure the target computer's IP address is valid, on the same subnet and powered on. Ensure no MAC address filtering or hardware access control devices are present. Use a simple hub/switch environment.	Yes	Go to step 5	
	No	If the symptoms do not change, replace the logic board.	**M10**
5. Verify Ethernet performance and reliability by starting up from a known-good OS install, and downloading a large file from a web site or file server.	Yes	If there is no performance or connectivity issue isolated solely to the system under test, the problem may be the network environment. No repair is necessary.	
	No	If there are connection dropouts or poor performance not seen on a known-good test system, replace the logic board.	**M10**

AirPort/Bluetooth: Defective Wireless Devices

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case

Caution: When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

Quick Check

Symptom	Quick Check
AirPort or Bluetooth: Defective Wireless Devices • Unable to join networks or pair devices • Card not available or recognized • Intermittent device or connection dropouts	**1.** Open System Preferences and make sure AirPort or Bluetooth is turned on and (for AirPort) that a network is selected. **2.** Check that base station is not using unsupported connection and encryption protocols. **3.** Check for nearby interference sources such as microwave ovens or cordless phones (**Knowledge Base HT1365**) **4.** Check the number of users trying to use AirPort in the area for possible network congestion. **5.** Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth). **6.** Reset PRAM.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort or Bluetooth is recognized. Ensure software and firmware updates for AirPort and Bluetooth have been applied.	Yes	(AirPort) Ensure MAC address filtering is not enabled on the base station. (Bluetooth) Ensure target devices are set to discoverable.	
	No	If card is not detected or software updates do not resolve issue, go to step 2.	

2. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection.	**N04**
	No	AirPort issue, go to step 3, Bluetooth issue go to step 7.	
3. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna.	**N04**
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. (AirPort) Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	**N14**
	No	Continue to use known-good antenna, go to step 5.	
5. (AirPort) Try a known-good AirPort card.	Yes	Replace AirPort card.	**N12**
	No	Go to step 6.	
6. (AirPort) Try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**
7. (Bluetooth) Enable Bluetooth and try a known-good Bluetooth card. Although Bluetooth cabling is part of camera cable, Bluetooth card is separate. Verify that System Profiler sees known-good Bluetooth card.	Yes	Replace Bluetooth card.	**N15**
	No	Go to step 8.	
8. (Bluetooth) Enable Bluetooth and try a known-good display assembly, if available, and Bluetooth card. Bluetooth cabling is part of camera cable. Verify that System Profiler sees known-good Bluetooth card.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

No/Poor Wireless Signal

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case

Quick Check

Symptom	Quick Check
No/Poor Wireless Signal • Unable to find networks • Intermittent connection dropouts • Slow transfer speeds	**1.** Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones (**Knowledge Base HT1365**). **2.** Check that computer is within base station range – move closer to base station. **3.** Base station checks: a. Base station is not set to low-power transmission mode b. Base station is not using unsupported connection and encryption protocols c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel) **4.** Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station.

Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort card is recognized under Network: AirPort Card.	Yes	Use Software Update to make sure all AirPort software and firmware updates have been applied. Ensure base station is not using MAC address filtering or creating a hidden network.	
	No	If card is not detected, go to M11 - AirPort/Bluetooth - Defective wireless devices.	
2. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection	**N04**
	No	Go to step 3.	

3. Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna	**N04**
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	**N14**
	No	Continue to use known good antenna, go to step 5.	
5. Try a known-good AirPort card.	Yes	Replace AirPort card.	**N12**
	No	Continue to use known-good antenna & card; go to step 6.	
6. Try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

Bluetooth Wireless Input Device Loses Connection

Unlikely cause: display assembly, speaker assembly, optical drive, hard drive

Quick Check

Symptom	**Quick Check**
Bluetooth Wireless Input Device Loses Connection	Check Bluetooth input device has fully charged batteries.

Deep Dive

Check	**Result**	**Action**	**Code**
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	

2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Ensure a known-good Bluetooth device is on, in close range and in discoverable mode. Is computer pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4	
	No	Attempt Bluetooth repair, go to step 5.	
4. Is computer pairing with user's Bluetooth device?	Yes	Connection established, continue testing for connection loss, go to step 8.	
	No	Check for software updates for both computer & device.	**K07**
5. Reseat camera cable on logic board. Verify that a USB Bluetooth controller is visible in System Profiler.	Yes	Loose cable connection.	**N04**
	No	Go to step 6.	
6. Install a known-good Bluetooth card. Verify that a USB Bluetooth controller is visible in System Profiler.	Yes	Replace Bluetooth card	**N15**
	No	Go to step 7	
7. Install and test a known-good display assembly. Verify that a USB Bluetooth controller is visible in System Profiler.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**
8. Continue to test a known-good Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Is link lost during test?	Yes	Check for software update, 2.4 GHz radio interference or device low battery. If still losing link, replace Bluetooth card. If installed Bluetooth card is known-good or was already replaced, replace top case (for Bluetooth antenna).	**N14** **N14**
	No	Known-good device passed test.	

AirPort Card: Kernel Panic

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case

Quick Check

Symptom	Quick Check
AirPort Card: Kernel Panic • Kernel panic on boot • Kernel panic or freezing while attempting to connect to Wi-Fi networks • Kernel panic while transferring data on Wi-Fi networks.	**1.** Isolate OS by booting from original install media (10.5.x). Attempt to connect to Wi-Fi network. **2.** Use Software Update to make sure all AirPort software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Use Software Update to make sure all AirPort/Bluetooth software and firmware updates have been applied. Ensure MAC address filtering is not enabled on the base station. Is kernel panic resolved?	Yes	Software issue.	
	No	Go to step 2.	
2. Reseat the camera cable connection to the logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to step 3.	
3. Isolate AirPort card by removing the I/O connection from the AirPort card. Reconnect camera cable connection to logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to M06 Kernel Panic / System Crashes.	
4. Connect and test with a known-good AirPort card. Is kernel panic resolved?	Yes	Replace AirPort card.	**N13**
	No	Replace display assembly.	**L16**

Wireless Performance Issue / Slow Connection

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case

Quick Check

Symptom	Quick Check
Wireless Performance Issue / Slow Connection • Slow or stalled data transfers • Intermittent connection dropouts	**1.** Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens or cordless phones (**Knowledge Base HT1365**) **2.** (AirPort) Check the number of users trying to use AirPort in the area for possible network congestion. Move closer to base station to improve signal reception. **3.** (Bluetooth) Move devices closer together. **4.** Check performance with a known-good system **5.** (AirPort) Wireless base station checks: a. Base station is not set to low-power transmission mode. b. Base station is not set to a slower protocol mode (802.11b). c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel). **6.** Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth) **7.** Use Software Update to make sure all AirPort and Bluetooth software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Inspect the display clutch barrel for damage. AirPort radio is in display clutch barrel area.	Yes	Record damage: Proceed to possibly repair damaged parts, go to step 2	
	No	No visible damage, go to step 2	

2. Turn off Bluetooth. Retest AirPort performance. Refer to **Knowledge Base TS1809**.	Yes	Possible AirPort interference from the Bluetooth card. Change AirPort base station channel. (**Knowledge Base TS1809**.)	**N06**
	No	Continue by checking connections, go to step 3	
3. Reseat the camera cable connection to the logic board.	Yes	Loose logic board connection	**N04**
	No	AirPort issue, go to step 4, Bluetooth issue, go to step 8.	
4. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connection or crossed antenna	**N04**
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 5	
5. (AirPort) Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	**N14**
	No	Continue to use known good antenna, go to step 6.	
6. (AirPort) Try a known-good AirPort card.	Yes	Replace AirPort card.	**N12**
	No	Continue to use known-good antenna & card, go to step 7.	
7. (AirPort) Try a known-good display assembly if available.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**
8. (Bluetooth) Enable Bluetooth and try a known-good Bluetooth card if available. Verify that Bluetooth is pairing with known-good device.	Yes	Replace Bluetooth card.	**N15**
	No	Go to step 9.	
9. (Bluetooth) Enable Bluetooth and try a known-good antenna assembly if available. Verify that pairing issue is fixed.	Yes	Replace top case.	**N14**
	No	Go to step 10.	

10. (Bluetooth) Enable Bluetooth and try a known-good display assembly if available. Verify that Bluetooth is pairing with known-good device.	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

Wireless Input Device Doesn't Pair

Unlikely cause: display assembly, logic board, optical drive, hard drive

Quick Check

Symptom	**Quick Check**
Wireless Input Device Doesn't Pair • Can't get the system to recognize the Bluetooth keyboard or mouse	**1.** Check Bluetooth System Preference is set to Discoverable. **2.** Check Bluetooth device has fully charged batteries. **3.** Check for Bluetooth software updates for both the device and Mac OS X. **4.** If the Bluetooth pairs with no problems, probe about potential interference issue at user's site.

Deep Dive

Check	**Result**	**Action**	**Code**
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	

3. Ensure a known-good Bluetooth device is on, in close range and discoverable mode, Is system pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4.	
	No	Attempt Bluetooth repair, go to step 5.	
4. Is Bluetooth pairing with user's Bluetooth device?	Yes	Issue resolved.	
	No	Check for SW update for both System and user device.	
5. Reseat camera cable with logic board. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Bad logic board connection. Issue resolved.	
	No	Go to step 6.	
6. (Bluetooth) Enable Bluetooth and try a known-good Bluetooth card if available. Is pairing issue fixed?	Yes	Replace Bluetooth card.	**N15**
	No	Go to step 7.	
7. (Bluetooth) Enable Bluetooth and try a known-good antenna assembly if available. Is pairing fixed?	Yes	Replace top case.	**N14**
	No	Go to step 8.	
8. (Bluetooth) Enable Bluetooth and try a known-good display assembly if available. Is Bluetooth pairing with a known-good device?	Yes	Replace display assembly.	**L16**
	No	Replace logic board.	**M11**

Uncategorized Symptom

Quick Check

Symptom	**Quick Check**
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to smfeedback@apple.com stating that a suitable symptom code could not be found.

Display

Display Anomalies

Quick Check

Symptom	Quick Check
Display Anomalies • Incorrect/missing colors • Distorted/blurred image • Pixel anomalies • Vertical/horizontal lines • Non-uniform brightness • Image flicker • Image persistence	**1.** Allow display to reach normal operating temperature for about 15 minutes before evaluating front-of-screen performance. **2.** Check display preferences for use of custom display profile. **3.** Check brightness setting. **4.** Check for Software Updates. **5.** Clean glass panel while checking for dust/debris. **6.** Go to Deep Dive: General

Deep Dive: General

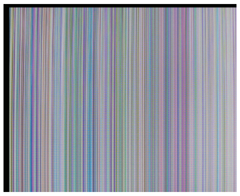
Check	Result	Action	Code
1. Verify if user's issue is incorrect/ missing colors.	Yes	Go to Incorrect/Missing Colors Deep Dive.	
	No	Go to step 2.	
2. Verify if user's issue is distorted/ blurred image.	Yes	Go to Distorted/Blurred Image Deep Dive.	
	No	Go to step 3.	
3. Verify if user's issue is bright or dark pixel anomalies.	Yes	Go to Pixel Anomalies Deep Dive.	
	No	Go to step 4.	
4. Verify if user's issue is vertical or horizontal lines.	Yes	Go to Vertical/Horizontal Lines Deep Dive.	
	No	Go to step 5.	

5. Verify if user's issue is non-uniform brightness.	Yes	Go to **Non-uniform Brightness Deep Dive**.	
	No	LCD functioning OK.	

Deep Dive: Incorrect/Missing Colors

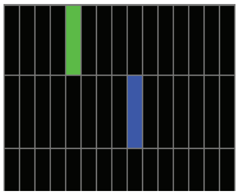
Check	**Result**	**Action**	**Code**
1. Verify display is listed in the System Profiler's Graphics/ Displays device tree.	Yes	This ensures color profile can be matched with LCD. Go to step 2.	
	No	Go to N09.	
2. Verify System Preferences Display Profile is valid for display being tested. Color profile should be set to Color LCD, user may have created an off-color calibration setting.	Yes	If display profile is valid and the colors are still incorrect or missing go to step 3.	
	No	Set System Preferences: Displays: Color to Color LCD and retest.	
3. Verify that the glass panel is free of contaminants.	Yes	Go to step 4.	
	No	Clean glass panel using approved method. Retest.	
4. Reseat and verify LVDS cable is secure to the logic board. Are colors restored?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 5.	
5. Set desktop pattern in System Preferences to 'Solid Gray Light'. Verify if incorrect/missing color issue affects entire display.	Yes	Test a known-good display, go to step 7.	
	No	Go to step 6.	
6. Set up display under test side by side with another known good display showing the same image. Verify if issue is noticeably worse on the display being tested.	Yes	Test a known-good display, go to step 7	**L02**
	No	Small variations in color uniformity are normal and do not warrant replacement or repair of the display.	
7. Substitute a known-good display assembly to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	**L02**
	No	Replace logic board.	**M04**

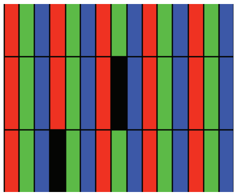
Deep Dive: Distorted/Blurred Image



Check	Result	Action	Code
1. Sample image illustrates loss of LVDS data signals to LCD or a defective LCD panel. Inspect & reseat LVDS cable connection looking for damaged or bent pins. Is image restored with reseated cable connection?	Yes	Issue due to loose connection. Display issue resolved.	
	No	Go to step 2.	
		If logic board connector damage, replace logic board.	**M24**
2. Substitute a known good display assembly to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	**L04**
	No	Replace logic board.	**M04**

Deep Dive: Pixel Anomalies





Check	Result	Action	Code
1. Determine if "defects" are dust/debris on surface of glass panel.	Yes	Clean glass panel.	
	No	Go to step 2.	
2. Determine if bright pixel defects exceed the acceptable number. See [Display Issue: Pixel Anomalies]().	Yes	Replace display assembly.	**L08**
	No	LCD meets bright pixel defect specifications. Go to step 3.	
3. Determine if dark pixel defects exceed the acceptable number. See [Display Issue: Pixel Anomalies]().	Yes	Replace display assembly.	**L08**
	No	LCD meets dark pixel defect specifications. Go to step 4.	
4. Determine if the combination of bright/dark pixel defects exceed the acceptable number. See [Display Issue: Pixel Anomalies]().	Yes	Replace display assembly.	**L08**
	No	Explain to user that LCD is within specifications. Do not replace display assembly.	

Deep Dive: Vertical/Horizontal Lines

Check	Result	Action	Code
1. Vertical or horizontal line or group of lines are in this category. Verify if display is listed in the System Profiler's Graphics/Displays device tree.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 2.	
2. Reseat the LVDS cable to the logic board. Did lines in question go away?	Yes	Issue resolved by reseating loose LVDS cable.	
	No	Go to step 3..	
3. Substitute a known-good display assembly to test logic board video output. Is normal video restored?.	Yes	Replace display assembly.	**L05**
	No	Replace logic board.	**M04**

Deep Dive: Non-uniform Brightness

Check	Result	Action	Code
1. Determine if brightness uniformity issue is visible after display has warmed up for 15 minutes.	Yes	Go to step 2.	
	No	Display backlight can take several minutes to stabilize.	
2. Check LVDS cable connection to logic board.	Yes	Reseat LVDS cable	
	No	Got to step 3	
3. Determine if variation in uniformity appears excessive when compared to another similar unit.	Yes	Replace display assembly.	**L07**
	No	Explain to user that LCD appears to meet specifications.	

Defective Camera / Built-in iSight Not Operating Correctly

Quick Check

Symptom	Quick Check
Defective Camera • Camera not detected • No green LED for camera • Excessive blooming • Poor white balance • Poor focus • Green image • Image distortion	**1.** Check for Software Updates. **2.** Verify camera lens and glass panel are clear of contaminants.

Deep Dive

Check	Result	Action	Code
1. Launch System Profiler and confirm that "Built-in iSight" is listed under USB High-Speed Bus.	Yes	Camera recognized. Go to step 3	
	No	Go to step 2.	
2. Inspect and reseat camera cable on logic board. Is iSight listed in System Profiler?	Yes	Camera recognized. Go to step 3.	
	No	Go to step 4.	
3. Launch PhotoBooth. Verify that camera's green LED is on and image appears normal.	Yes	Issue resolved..	
	No	Go to step 4.	
4. Substitute a known-good display assembly to test logic board camera connection. Is iSight camera operating properly?	Yes	Replace display assembly.	**X11**
	No	Replace logic board.	**M13**

Blank / No Video

Unlikely cause: Power adapter, speakers, ODD/HDD, fan, microphone, top case

Quick Check

Symptom	Quick Check
Blank / No Video • No video • No backlight	**1.** Check brightness setting **2.** Attach known-good supported external display. **3.** Boot from Mac OS X install DVD that came with computer.

Deep Dive

Check	Result	Action	Code
1. Verify boot chime present when system restarted. Reset SMC and clear PRAM if necessary for proper start up. Is LCD video present?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Connect known-good supported external display. Verify whether image appears on external display when system is booted.	Yes	External display detected by system. Go to step 3.	
	No	Go to No Video symptom code flow.	
3. Verify if LCD backlight is on by looking for faint glow from display when viewed in darkened room with brightness adjusted to full.	Yes	Video signal from system to external video is OK, LCD backlight is on. Go to step 5.	
	No	Go to step 4.	
4. Shine bright (low heat) flashlight into the front of LCD. Verify if an image is being displayed.	Yes	Image present but backlight is not on. Check logic board connections. Go to step 5.	
	No	Go to No Video symptom code flow.	
5. Reseat and verify that the display connections to the logic board are secure. Verify if image is restored by reseating loose connections	Yes	Issue resolved.	
	No	Continue to test with known-good display assembly. Go to step 6.	

6. Verify LCD video works with a known-good display assembly.	Yes	Replace display assembly.	**L03**
	No	Go to No Video symptom code flow.	

Backlight Issue / No Backlight

Unlikely cause: Power adapter, battery, speaker, ODD/HDD, fan microphone, top case

Quick Check

Symptom	**Quick Check**
Backlight Issue / No Backlight • Display not illuminated • Flashing, unstable or non uniform background lighting • Poor backlight at some or all settings	Check that brightness setting is above minimum.

Deep Dive

Check	**Result**	**Action**	**Code**
1. Connect external display, clear PRAM to set brightness to default level and verify if Color LCD is listed in the System Profiler's Graphics/Displays device tree.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 2.	
2. Unplug and reseat the LVDS cable at the logic board. Repeat verification in System Profiler.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 4.	
3. Darken room and verify backlight by detecting if any glow is emitted from the display	Yes	Backlight operating. Go to step 5.	
	No	Go to step 4.	
4. Swap memory with known-good memory to determine if video.	Yes	Reseat or replace defective memory	**X01**
	No	Go to step 5	

5. Inspect LVDS connectors and cable under magnification for pinched cables and damaged or bent pins. Do any of the connections appear to be defective?	Yes	Defective LVDS cable. Replace display assembly. Defective LVDS connector on logic board. Replace logic board.	**L09** **M25**
	No	If connections are OK and secure and the display is still blank, go to step 6.	
6. Substitute a known-good display assembly to test logic board video output. Is backlight and display text back to normal?	Yes	Replace display assembly.	**L09**
	No	Poor or no backlight LED Driver power at logic board. Replace logic board.	**M25**

Noise / Unstable Flickering

Unlikely cause: Top case, battery

Quick Check

Symptom	**Quick Check**
Noise / Unstable Flickering • Image flicker • Audible noise	**1.** Verify known-good source sound file not causing speaker distortion.

Deep Dive

Check	**Result**	**Action**	**Code**
1. Verify if user's issue is due to video flickering coming from display.	Yes	Suspected flickering issue, go to step 2.	
	No	Audible noise issue, go to step 5.	
2. Verify display listed in the System Profiler's Graphics/ Displays device tree is not disappearing intermittently (refresh System Profiler to observe).	Yes	Power and LCD panel ID are OK. Go to step 3.	
	No	Go to No Video symptom code flow.	

3. Inspect and reseat the LVDS cable and camera cable connection between display and logic board. Also test if brightness setting is a contributing factor. Has flickering stopped?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 4.	
4. Substitute a known good display assembly to test logic board video output. Has flickering stopped?	Yes	Replace display assembly.	**L06**
	No	Replace logic board.	**M04**
5. Verify source of noise is electrical, not mechanical. Audio noise should not be a concern since LCD components are all solid state devices including LED backlights.	Yes	Noises that are not audible from the normal user position are considered acceptable. Return unit to the user.	
	No	Noise from other source. Go to P04 Noise/Hum/vibration.	

Mechanical/Physical Damage

Quick Check

Symptom	**Quick Check**
Mechanical/Physical Damage • Broken glass • Broken hinge • Stripped screw/head • Stripped screw boss • Dent or scratch to chassis	**1.** Determine damage caused by user/technician environment, accidental damage, or abuse. **2.** Inform user/technician the failures are not covered by Apple warranties. Refer to http://www.apple.com/legal/warranty

Cosmetic Defects

Quick Check

Symptom	Quick Check
Cosmetic Defects • Cracked LCD • Scorched or melted LCD • LCD impact damage	**1.** Determine damage caused by user/technician environment, accidental damage, or abuse. **2.** Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback@apple.com** stating that a suitable symptom code could not be found.

Mass Storage

Hard Drive Read/Write Issue

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Hard Drive Read/Write Issue **Bad Sector/Defective** **Drive Formatting Issue** • Cannot save documents • Read/Write error message • Hang when accessing or saving data	**1.** Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility. **2.** Repair disk using Disk Utility. **3.** Erase disk and reinstall Mac OS using Installer.

Deep Dive

Check	Result	Action	Code
1. Start up from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer. Go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does system start up to desktop?	Yes	Reinstall user's drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	

4. After reseating hard drive SATA and logic board connections, does known-good hard drive boot to desktop?	Yes	Reinstall user's drive, go to step 2	
	No	Suspect hard drive SATA cable, go to step 5.	
5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Reinstall user's drive, go to step 2.	**X03**
	No	Replace logic board.	**M19**
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Repair or replace hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved	
	No	Hard drive appears to be defective, go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	**H01**
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	**M19**

Hard Drive Not Recognized/Not Mounting

Unlikely cause: LCD, speakers, fan, camera, microphone, AirPort

Quick Check

Symptom	**Quick Check**
Hard Drive Not Recognized/ Mount **Drive No Boot** • Flashing question mark • Boots to grey screen • Boots to blue screen	**1.** Use a known-good mouse. Stuck mouse button will not allow boot. **2.** Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility. **3.** Repair disk using Disk Utility. **4.** Erase disk and reinstall Mac OS using Installer.

Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer, go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does computer start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	
4. After reseating SATA and logic board connections, does known-good hard drive start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Suspect hard drive SATA cable, go to step 5.	
5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Install user drive, go to step 2.	**X03**
	No	Replace logic board.	**M19**
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Restore or replace user's hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved.	
	No	Hard drive appears to be defective. Go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	**H01**
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	**M19**

Hard Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Hard Drive Noisy • Noise during start up • Noise during operation • Noise when drive is copying or saving data	**1.** Start up from Install DVD. Verify S.M.A.R.T. status of hard drive using Disk Utility. **2.** Repair disk using Disk Utility. **3.** Check for reported noise and compare with Knowledge Base article "Apple Portables: Hard Drives and Noise" **http://support.apple.com/kb/TS2354**

Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Replace hard drive or go to H01 Drive not recognized/ mount.	
2. Repair disk using Disk Utility and verify it completed successfully	Yes	Restart computer. Go to step 3.	
	No	Go to step 4.	
3. Is hard drive still noisy?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	
4. Erase disk and reinstall Mac OS using Installer. Did process complete?	Yes	Restart computer. Go to step 3.	
	No	Replace hard drive. Go to step 5.	**H06**

5. After installing new hard drive, do you still have drive noise?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	
6. After removing hard drive, verify if the system is still noisy.	Yes	Fan noise or optical drive noise likely to be the cause. See ODD Noisy table and Fan failures/Thermal issues table.	
	No	Go to step 7.	
7. Install a known-good hard drive and verify if the noise level is similar to user's hard drive.	Yes	Hard drive noise level is similar to a known-good drive and does not require replacement.	
	No	Replace hard drive. Go to step 5.	**H06**

Optical Drive Won't Accept/Reject Media

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Won't Accept/ Reject Media • Cannot insert a disc into the drive • Cannot eject a disc placed into the drive	**1.** Use Apple System Profiler ATA section to see if the optical drive appears. If not, see Optical Drive Not Recognized., **2.** Restart computer and hold down mouse button or keyboard eject key to cycle optical drive. **3.** Inspect optical drive slot for obstructions

Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for serial-ATA devices in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Inspect hardware. Go to step 2	
2. Verify all connections between logic board, flex cable, and optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	**X03**
3. Disconnect user's optical drive by lifting SATA cable at logic board and connecting a known good optical drive assembly. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test user's optical drive with replacement SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue.	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**
5. Inspect optical drive slot for disc insert/eject. Is there clearance for disc use?	Yes	Go to step 6.	
	No	Replace damaged optical drive or system top case that interferes with disc use.	**J01** **(J05)** **X13**
6. Insert known-good disc and test user's optical drive for acceptance of disc. Does disc auto eject?	Yes	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**
	No	Go to step 7.	
7. Does disc mount to desktop?	Yes	Go to Eject Test step 8.	
	No	Go to Optical Drive Read/Write Data Error troubleshooting page.	

8. Does disc eject properly from optical drive?	Yes	Issue resolved.	
	No	Replace optical drive or top case that interferes with disc ejection.	**J02** **X13**
9. With replacement flex cable and interconnect board, is disc now recognized?	Yes	Issue resolved.	
	No	Replace optical drive. If drive has already been replaced, then replace logic board.	**J03**

Optical Drive Read/Write Data Error

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	**Quick Check**
Optical Drive Read/Write Data Error • Errors when writing optical media. • Errors when reading optical media. • Hang when accessing or preparing to write data.	**1.** Test optical media in another drive of the same type in same type of machine to rule out media issue. **2.** Check with known-good discs like the Install discs that came with the computer. **3.** For write issues, check with known-good media that performs well in another computer and optical drive of the same type. **4.** Check both CD and DVD media. If only one type of media is producing errors, there is a laser issue. (J99)

Deep Dive

Check	**Result**	**Action**	**Code**
1. Is media free to spin without optical drive scraping edge or surface of media?	Yes	Go to step 2.	
	No	Replace optical drive.	**J03**

2. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 6	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	**J03**
		Optical drive cannot read any media reliably, go to step 3.	
3. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	**X03**
	No	Go to step 4.	
4. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good optical drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 5.	
	No	Replace logic board.	**M19**
5. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J05)**
6. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably.	Yes	Issue resolved.	
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**

Optical Drive Not Recognized/Mount

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Not Recognized/ Mount - Discs inject and eject, but do not appear in Finder	**1.** Use Apple System Profiler ATA section to see if the optical drive appears. **2.** Serial-ATA section of Apple System Profiler will show any media inserted. **3.** Check Finder Preferences: General and make sure "CD's, DVD's and iPods" is checked under "Show these items on the Desktop." **4.** Check both CD and DVD media. If only one type of media is recognized, there might be a laser related issue. (J99)

Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for SATA devices in System Profiler?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Verify all connections between logic board, flex cable, optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Issue resolved.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	**X03**
3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**
4. Install and test with replacement optical drive SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue	**X03**
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J05)**

Optical Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Noisy • Noise during boot • Noise during operation • Noise when drive is copying or writing data	**1.** Test optical media in another drive of the same type in same type of computer to rule out media issue. **2.** Check with known-good discs. Install discs that came with the computer. **3.** Check to see if noise occurs without media in the drive. If so, check for hard drive (H06) and fan (M18) caused noise.

Deep Dive

Check	Result	Action	Code
1. Is optical drive constantly seeking or cycling eject mechanism without an optical disc installed? Optical drive should perform only one reset sequence and rest idle, ready for media.	Yes	Continue and verify with media, go to step 2.	
	No	Replace optical drive if continuous activity occurs with no disc installed.	**J04**
2. Insert known good data CD. Is media free to spin without optical drive scraping edge or surface of media? Verify disc does not exceed maximum thickness specification.	Yes	Continue and verify with media, go to step 3.	
	No	Internal mechanical interference is affecting rotational spin of media, replace optical drive.	**J04**
3. Initial disc handling noise is normal. Disc spinning and head seek indicate disc is mounting to desktop. Seek noise should settle down once mounted. Is noise above normal and related to seek activity?	Yes	Replace optical drive.	**J04**
	No	Go to step 4.	

4. Disc spin should cease 30 seconds after mounting data CD on OS desktop. Is the noise related to disc spin?	Yes	Go to step 5.	
	No	Go to step 6.	
5. Remove the optical drive and check for the correct seating of the brackets on the optical drive and in the top case. Reinstall drive in unit and retest. Verify if drive is still noisy.	Yes	Go to step 6.	
	No	Issue resolved. Optical drive was not properly mounted in enclosure. (Possible physical damage to optical drive.)	**(J05)**
6. Eject known good data CD. Disc handling noise should be one pop of disc from motor hub and a motor gear sound driving disc out of optical drive. Is noise above normal and related to disc eject activity or multiple eject attempts?	Yes	Replace optical drive.	**J02**
	No	Go to step 7.	
7. Disc spin should cease 30 seconds after mounting data CD on desktop. Media may be mounting on a defective internal spindle hub. Is the noise related to disc spin?	Yes	Replace optical drive.	**J04**
	No	Noise does not appear to be related to optical drive.	

Optical Drive Not Performing to Specs

Unlikely cause: LCD, speakers, fan, camera, microphone

Quick Check

Symptom	Quick Check
Optical Drive Not Performing to Specs Read or write speeds slower than expected.	**1.** Test optical media in another drive of the same type in same type of computer to rule out media issue. **2.** Check with known-good discs—Install discs that came with the computer. **3.** For disc write issues, check with known-good media that performs well in another computer and drive of the same type. **4.** Check both CD and DVD media. If only one type of media is producing errors, there might be a laser related issue. (J99)

Deep Dive

Check	Result	Action	Code
1. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 5	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	**J03**
		Optical drive cannot read any media reliably. Go to step 2.	
2. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	**X03**
	No	Go to step 3.	
3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	**M19**

4. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	**X03**
	No	Replace optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J05)**
5. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably.	Yes	Issue resolved.	
	No	Replace optical drive. (Mechanical damage to optical drive, if found)	**J03** **(J06)**

Uncategorized Symptom

Quick Check

Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to smfeedback@apple.com stating that a suitable symptom code could not be found.

Input/Output Devices

USB Port Does Not Recognize Known Devices

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
USB Port Does Not Recognize Known Devices USB-wired keyboard/mouse or USB flash drive not recognized	**1.** Check the for latest software update. **2.** Use Apple System Profiler to verify the computer recognizes the USB bus. **3.** Test port with known good Apple keyboard or mouse. **4.** Verify any USB hubs have sufficient power.

Deep Dive

Check	Result	Action	Code
1. Reset SMC and clear PRAM. Was USB device recognized?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Is USB device receiving power from USB port? Note: first device to need >500ma will get 1000ma, all others are limited to <500ma.	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. Is the latest Mac-compatible USB software driver for this USB device installed?	Yes	Replace logic board.	**M15**
	No	Obtain Mac-compatible USB driver.	

Built-in Keyboard Does Not Work Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Does Not Work Properly • Keystrokes not recognized • Locks up • Displayed characters don't match	**1.** In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from the Input Menu in the menu bar. Test the keyboard. **2.** Confirm correct keyboard layout is selected. **3.** Update to the latest system software. **4.** Press Caps Lock, if the Caps Lock light goes on to show at least a partial connection to the main logic board.

Deep Dive

Check	Result	Action	Code
1. If specific keys are not working, confirm if they are physically broken.	Yes	Replace top case. Go to step 4.	
	No	Go to step 2.	
2. Reseat keyboard flex cable to logic board and verify that all keys are functional.	Yes	Issue resolved.	**X99**
	No	Go to step 3.	
3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Replace top case. Go to step 5.	**K01**
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly. Reseat cable and verify with ASD that all keys are functional.	Yes	Issue resolved.	**K01**
	No	Replace top case. Go to step 5.	
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	**K01**
	No	Replace logic board.	**M15**

Specific Keys Don't Work

Unlikely cause: power adapter, battery, speakers, LCD, ODD/HDD, fan, microphone

Quick Check

Symptom	Quick Check
Specific Keys Don't Work • Keycap broken • Key switch broken • Sticky key • Key pressed not recognized	**1.** Determine if damage caused by user/technician environment, accidental damage, or abuse. **2.** Inform user/technician the failures are not covered by Apple warranties. Refer to **http://www.apple.com/legal/warranty** **3.** Inspect keycap to remove debris trapped under it. **4.** If the keycap is loose, check if clasp is still intact and reattach it. **5.** Repair is a top case replacement. Use the following symptom code: - Inoperative keys (**K01**) - Sticky keys (**K05**).

Built-in Trackpad Does Not Work

Quick Check

Symptom	Quick Check
Built-in Trackpad Does Not Work • Cursor does not move. • Select button of trackpad inoperable • Multiple touch features inoperable	**1.** Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands. **2.** Clean the trackpad surface (with the computer powered off) using a clean, dry, lint-free cloth. **3.** Make sure all software and firmware updates have been applied.

Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed on USB in Apple System Profiler?	Yes	Go to step 5.	
	No	Go to step 2.	

2. Does trackpad look damaged? Verify trackpad alignment is correct and click-depth set screw is at factory setting.	Yes	Replace top case. Go to step 6.	
	No	Go to step 3.	
3. Reseat the trackpad flex cable to the logic board. Does trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Set for normal use, enable and test multiple touch features. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6	
6. Does the select button click? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	All trackpad issues resolved.	
	No	Go to step 7	
7. Does a known-good top case work?	Yes	Replace top case.	**K02**
	No	Replace logic board.	**M16**

Built-in Keyboard Has Dim or No Keyboard Backlight

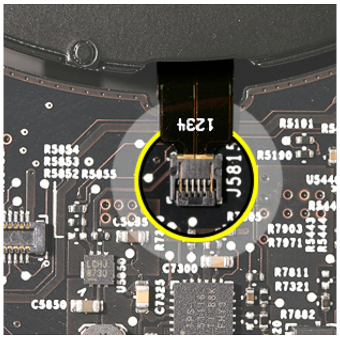
Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	**Quick Check**
Built-in Keyboard Has Dim or No Backlight • In darkened room, keyboard backlight does not come on or is dim.	**1.** Make sure this computer model has a keyboard backlight option by checking the configuration label in the battery bay. **2.** Make sure that keyboard backlight is turned on and brightness turned up. **3.** Block the ambient light sensor to simulate darkened room.

Deep Dive

Check	Result	Action	Code
1. Cover the ambient light sensor, located near camera. Did the display dim?	Yes	Ambient light sensor is working. Go to step 4.	
	No	Go to step 2.	
2. Cover the ambient light sensor again. Did the keyboard backlight work?	Yes	Issue resolved.	
	No	Go to step 3.	
3. In the Apple System Profiler, can you see the AirPort and Bluetooth cards?	Yes	The light sensor connection to logic board is likely good. Replace display assembly.	**L14**
	No	Go to step 4.	
4. Reseat the keyboard backlight connection to the logic board. Does the keyboard backlight work now?	Yes	Issue resolved.	
	No	Go to step 5	
5. Measure the voltage between pin 4 and pin 2 of the keyboard backlight connector J5815. Is there voltage present with the running system in a dark room?	Yes	Replace top case.	**K10**
	No	Replace logic board.	**M99**



Built-in Keyboard Is Not Recognized

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Keyboard Is Not Recognized • Keystrokes not recognized	**1.** Reset SMC. **2.** Press Caps Lock. If the Caps Lock light comes on that indicates at least a partial connection to the logic board. **3.** In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from the Input Menu in the menu bar. Test the keyboard.

Deep Dive

Check	Result	Action	Code
1. In Apple System Profiler do you see “Apple Internal Keyboard/ Trackpad” listed under USB hardware devices?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Reset SMC and verify if keyboard/trackpad is now seen in Apple System Profiler.	Yes	Go to step 3.	
	No	Replace logic board.	**M15**
3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Replace top case. Go to step 5.	**K11**
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly.	Yes	Issue resolved.	
	No	Replace top case. Go to step 5.	**K11**
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	
	No	Replace logic board.	**M15**

Built-in Trackpad Does Not Track Properly

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Built-in Trackpad Does Not Track Properly • Cursor movement is random, uneven, or jumpy. • Cursor hangs or stalls along path.	**1.** Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands. **2.** Clean the trackpad surface (with the computer off) using a clean, dry, lint free cloth. **3.** Make sure all software and firmware updates have been applied. **4.** If the issue occurs when system is running from the power adapter, use a grounded power cord with the power adapter.

Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed under USB in Apple System Profiler?	Yes	Trackpad communicating to system. Go to step 5.	
	No	Go to step 2	
2. Does the trackpad look damaged?	Yes	Replace top case. Go to step 6.	**K02**
	No	Go to step 3.	
3. Reseat the trackpad flex cable on the logic board. Does the trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	**M24**
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6.	

6. Does a known-good top case work?	Yes	Replace top case for defective trackpad. Issue resolved.	**K02**
	No	Replace logic board.	**M16**

Apple Remote Inoperable

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	**Quick Check**
Apple Remote Inoperable • Remote is not recognized.	**1.** The computer is on and awake. **2.** Check with known-good remote on user's computer and the user's remote on known-good computer **3.** Remote is used within 30 feet of the computer and unobstructed line-of-sight to the IR window. **4.** Clean the IR window. **5.** Open System Preferences: Security pane. Verify that "Disable remote control infrared receiver" is not checked. **6.** In Security pane, if "Unpair" button is active, press it and pair the Apple Remote. See "Pairing your Apple Remote with your computer" (**Knowledge Base HT1619**).

Deep Dive

Check	**Result**	**Action**	**Code**
1. Open Photo Booth or iChat's Video Preview window. Point Apple Remote at the built-in iSight camera, press any button on the remote, and verify that (as seen through the camera) there is a faint blinking light on the remote.	Yes	Apple Remote is working. Go to step 2.	
	No	Replace the remote's battery. Go to step 2.	

2. Verify that you can pair the Apple Remote with a known-good system?	Yes	Go to step 3.	
	No	Replace the Apple Remote. Go to step 3.	**X04**
3. Verify that Apple Remote now works.	Yes	Issue resolved.	
	No	Check and reseat IR/sleep LED board cable connection at logic board. Go to step 4.	
4. Does the Apple Remote now work?	Yes	Issue resolved.	
	No	Replace the hard drive front bracket (includes IR/sleep cable). Go to step 5.	
5. Does the Apple Remote now work?	Yes	Issue resolved.	**K99**
	No	Replace logic board.	**M15**

Built-in Speaker Has No Audio

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	**Quick Check**
Built-in Speaker Has No Audio Can't hear any audio from within the machine.	**1.** Make sure all software updates have been applied. **2.** Check in System Preferences: Sound: Output that sound output is set to "Internal Speakers". **3.** Use the F12 volume key to set the sound to maximum. **4.** Reset PRAM.

Deep Dive

Check	Result	Action	Code
1. Check System Preferences: Sound: Output and verify that no external speakers, "Digital Out," or headphones are being reported connected when there is none present.	Yes	Audio-out port is not damaged. Go to step 3.	
	No	Go to step 2	
2. With known-good headphone or speakers, plug in the audio output jack for several cycles. Verify that you get audio through external headphones/ speakers when connected.	Yes	Go to step 4	
	No	Reseat the speaker connectors to logic board. Go to step 3.	
3. Verify that you now get audio through internal speakers .	Yes	Issue resolved.	
	No	Replace logic board.	**M09**
4. Disconnect known-good headphones or speakers. Verify that you now get audio through internal speakers.	Yes	Issue resolved.	
	No	Replace affected speaker(s).	**X08**

Distorted Sound from Internal Speaker

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	Quick Check
Distorted Sound from Internal Speaker • Distorted audio	**1.** Reset PRAM. **2.** Adjust sound output and level in System Preferences: Sound: Output, and use the Balance to locate a left, right, or woofer speaker distortion source. **3.** Compare the same sound and same settings against another unit to make sure the sound is actually distorting.

Deep Dive

Check	Result	Action	Code
1. Comparing internal speakers with headphones, is the distortion on both headphones and speakers?	Yes	Audio source or gain issue. Reset PRAM, adjust sound level in System Preferences: Sound: Output, and retest with known-good audio source and external speakers. Go to step 5.	
	No	Internal speaker issue. Go to step 2.	
2. Use the Sound Output system preference to test the left and right speakers. If lower bass notes are distorted, right speaker/subwoofer may be defective. Are all speakers free of distortion, sounding clear and loud?.	Yes	Issue resolved.	
	No	Adjust volume to test full range of volume settings. Go to step 3.	
3. Is affected speaker cable properly inserted and free from damage?	Yes	Go to step 4.	
	No	Reseat speaker cable or replace damaged speaker. Go to step 5.	**X09**
4. Is affected speaker membrane free from dust or debris, and speaker membrane is not deformed/damaged?	Yes	Go to step 5.	
	No	Clean any dust or debris. Go to step 5. If membrane is damaged, replace the bad speaker(s).	**X09**
5. Verify that speaker enclosure is not damaged, correctly installed in system, and does not create unneeded vibration when sound is played.	Yes	Speaker housing and installation is good. Go to step 6.	
	No	Properly install or replace affected speaker. Go to step 6.	
6. Verify that internal speakers no longer produce distorted sound.	Yes	Issue resolved.	**X09**
	No	Replace logic board.	**M09**

Express Card Will Not Insert Into Slot

Unlikely cause: LCD, MLB, hard drive

Quick Check

Symptom	Quick Check
ExpressCard will not insert into ExpressCard Slot ExpressCard does not fully seat into the slot Slot door does not open completely	**1.** The card must be a 34mm wide card with the top side oriented up and not be warped or damaged. **2.** Clear any obstruction in the slot.

Deep Dive

Check	Result	Action	Code
1. Is the slot cover opening properly?	Yes	.Go to step 3	
	No	Re-seat the ExpressCard Cage and inspect the slot cover. Go to step 2.	
2. Does the slot cover open properly after the adjustments?	Yes	Issue resolved.	
	No	Replace top case.	**X13**
3. Can the ExpressCard slide completely into the slot?	Yes	Issue resolved.	
	No	Re-seat the ExpressCard Cage with the card already installed in the card cage.. Go to step 4.	
4. Ejecting the ExpressCard and re-inserting it, does it completely slide into the slot?	Yes	Issue resolved.	**X13**
	No	Replace the ExpressCard Cage.	**M17**

Express Card Not Recognized By System

Unlikely cause: LCD, MLB, HDD/ODD

Quick Check

Symptom	Quick Check
ExpressCard is not recognized by the system. Card does not show up on the desktop or in System Profiler	**1.** Check correct drivers are installed for the ExpressCard. **2.** Verify with known good USB and PCI Express based ExpressCards that the slot is good.

Deep Dive

Check	Result	Action	CSC
1. Does the ExpressCard cable connection to the main logic board look secure?	Yes	Go to step 3	
	No	Re-seat the ExpressCard Cage cable connection. Go to step 2.	
2. Is the card recognized?	Yes	Bad connection. Issue resolved.	**X04**
	No	Go to step 3	
3. Does the ExpressCard cage look damaged (connector or cage?	Yes	Replace the ExpressCard cage. Go to step 5	
	No	Remove the ExpressCard cage, install an ExpressCard (one fits completely inside), then re-installed the card cage. Go to step 4.	
4. Is the card recognized?	Yes	Card cage mounting issue. Issue resolved.	**X99**
	No	Replace the ExpressCard cage. Go to step 5	**X13**
5. Is the card recognized?	Yes	Bad ExpressCard cage. Issue resolved.	**X13**
	No	Replace the logic board.	**M17**

FireWire Port Not Recognizing Known Devices

Unlikely cause: LCD,HDD/ODD

Quick Check

Symptom	Quick Check
FireWire Port is not recognizing known devices Attached FireWire device like digital camera or mass storage drive not recognized by the system	**1.** Check for latest software update. **2.** Use Apple System Profiler to verify the computer recognizes the FireWire bus. **3.** Test port by connecting to another computer using FireWire Target Disk Mode. **4.** Verify the FireWire cable is good. **5.** Verify a self powered FireWire device is getting power

Deep Dive

Check	Result	Action	Code
After resetting SMC, was the FireWire Port recognized?	Yes	Issue resolved.	
	No	FireWire port is bad. Replace main logic board.	**M12**

Uncategorized Symptom

Quick Check

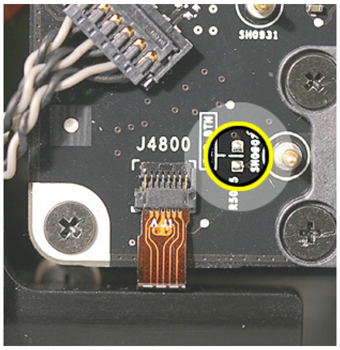
Symptom	Quick Check
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the customer. If not, document reported symptom and send feedback to **smfeedback@apple** stating that a suitable symptom code could not be found.

Mechanical Issues: Thermals and Enclosure

Reset/Power Button Stuck

Unlikely cause: LCD, hard drive, optical drive

Quick Check



Symptom	Quick Check
Reset/Power Button Stuck • System will not power on • System sounds bootROM unlock tone during startup • System automatically starts up repeatedly	**1.** Diagnose stuck button with SMC keyboard reset sequence **2.** Inspect keyboard connection to logic board. **3.** Try logic board power-on pads to determine open or closed power-on key. Closed circuit will not allow on-board switch to work. **4.** If stuck down or closed, remove keyboard cable from logic board and try on board switch again to determine if top case is defective. **5.** If logic board will not power on with keyboard cable removed, troubleshoot no power/no boot.

Deep Dive

Check	Result	Action	Code
1. Reset SMC using keyboard 3 keys and power-on key. MagSafe LED can verify SMC reset. Momentary stop of battery charging will indicate SMC reset, orange LED will go green momentarily then return to orange.	Yes	Keyboard reset works while holding 3 keys and toggling power-on key, multiple press and release of power-on key works to show power-on key not stuck or fixed.	
	No	SMC keyboard reset not working, suggests power-on key is open circuit or stuck down. Go to step 2.	

2. Remove battery and AC power for 30 seconds to perform a manual SMC reset. Apply AC power. Does power-on key work when pressed?	Yes	SMC restored from power removal sequence. Power-on key now working properly.	
	No	Power-on key stuck or open. Go to step 3.	
3. Inspect keyboard flex cable for loose or damaged connections. Align and reseat to flex cable to ensure proper connections. Does power-on key now work correctly?	Yes	Cable reseat restored power-on key operation.	
	No	Power-on key still stuck or open. Go to step 4.	
4. Use conductive tool to assert power on by touching power-on switch pads on logic board.	Yes	System powers on suggests top case power on key circuit is open. Replace top case.	**X14**
	No	Power-on key circuit may be closed suggesting a stuck power-on key. Go to step 5.	
5. Disconnect the internal keyboard flex cable and assert power-on switch pads on logic board. Removing top case power-on key from circuit should free on-board switch to work properly.	Yes	On board power-on switch pads now starts the system. Replace top case due to stuck power-on key.	**X14**
	No	Go to M01: No power/ not booting	

System Runs Hot

Unlikely cause: LCD, hard drive, optical drive

Quick Check

Symptom	**Quick Check**
System Runs Hot • System feels very warm • Fan(s) not working • Fan(s) are full on	**1.** Verify the computer operating on a flat, hard surface and the vents are not blocked. **2.** Verify the computer is not running hotter than expected for normal operation. If possible, compare to a similarly configured computer. **3.** Reset SMC. **4.** Inspect fan performance **5.** Run thermal sensor test.

Deep Dive

Check	Result	Action	Code
1. Is the system running as expected (compared to similar system)?	Yes	Use "Apple Portables: Operating Temperature" (**Knowledge Base HT1778**) to inform user it is operating normally.	
	No	Go to step 2.	
2. Are there runaway applications? See "Runaway applications can shorten battery run time" (**Knowledge Base TS1473**).	Yes	Check with the vendor for compatibility and software update.	
	No	Go to step 3.	
3. Fans are typically on at minimum speed. Perform SMC reset or remove all power for 15 minutes. Is the fan(s) running properly?	Yes	Go to step 5.	
	No	Fan(s) not running or always running at full speed. Go to step 4.	
4. Reseat fan connection to logic board or test a known-good fan. Replace a fan that is not spinning or replace logic board that is not spinning a known-good fan. Is fan(s) working properly?	Yes	Reseating or replacing bad fan resolved issue. Replace logic board if it does not work with known-good fan.	**X99 or M18**
	No	Go to step 5.	
5. Is the heatsink installed properly with no damage to heat fins?	Yes	Go to step 7.	
	No	Replace missing screws or damaged heatsink. Go to step 6.	
6. Is the system running as expected?	Yes	Heatsink installed incorrectly. Issue resolved.	**X10**
	No	Go to step 7.	
7. Heatsink thermal grease possibly missing or improperly installed during previous repair?	Yes	Replace heatsink or install thermal grease.	**X10**
	No	Go to step 8.	

8. Inspect and reseat connections to thermal sensors throughout the system, run test for sensor monitoring.	Yes	Thermal module or other sensor reseat resolved issue.	**X99**
	No	Replace logic board if sensor error. Go to step 9.	
9. After logic board replacement, is the computer running as expected?	Yes	Bad logic board. Issue resolved.	**M23**
	No	Use minimum configuration troubleshooting to isolate the issue.	

Uncategorized Symptom

Quick Check

Symptom	**Quick Check**
Uncategorized Symptom Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to **smfeedback@apple.com** stating that a suitable symptom code could not be found.

Apple Technician Guide

Take Apart

MacBook Pro (17-inch, Early 2009)

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General Information

Connector Types on Logic Board

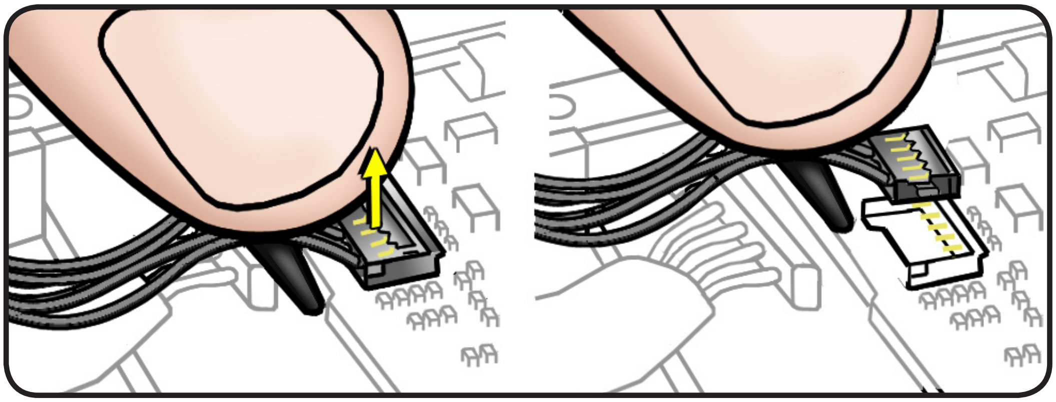
On the logic board are six types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.

Vertical Insertion (JST)

- Use black stick under cable to remove.
- Keep connector level to board when disconnecting and reconnecting.
- Press evenly when reconnecting or connector can be tipped up and not fully seated.

Examples:

- fan cables
- heatsink sensor
- right speaker
- left speaker and microphone on underside of board

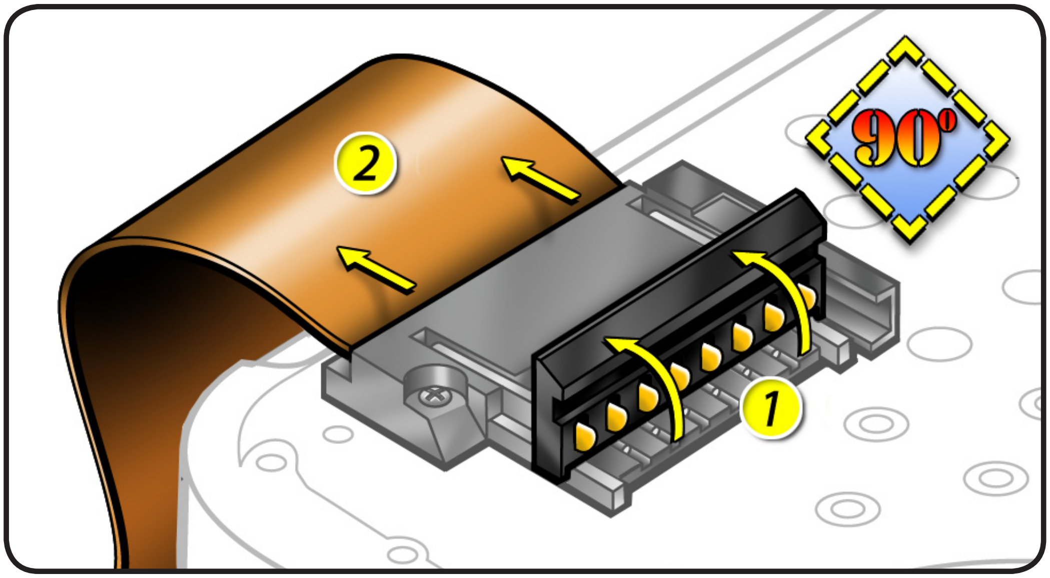


Locking Lever

- Flip up lever 90 degrees for cable removal.
- Slide connector into receptacle on same horizontal plane as board.
- Lock down lever after inserting cable.

Examples:

- IR/SIL flex cable
- keyboard backlight flex cable
- Express Card cable



- BIL cable
- keyboard flex cable

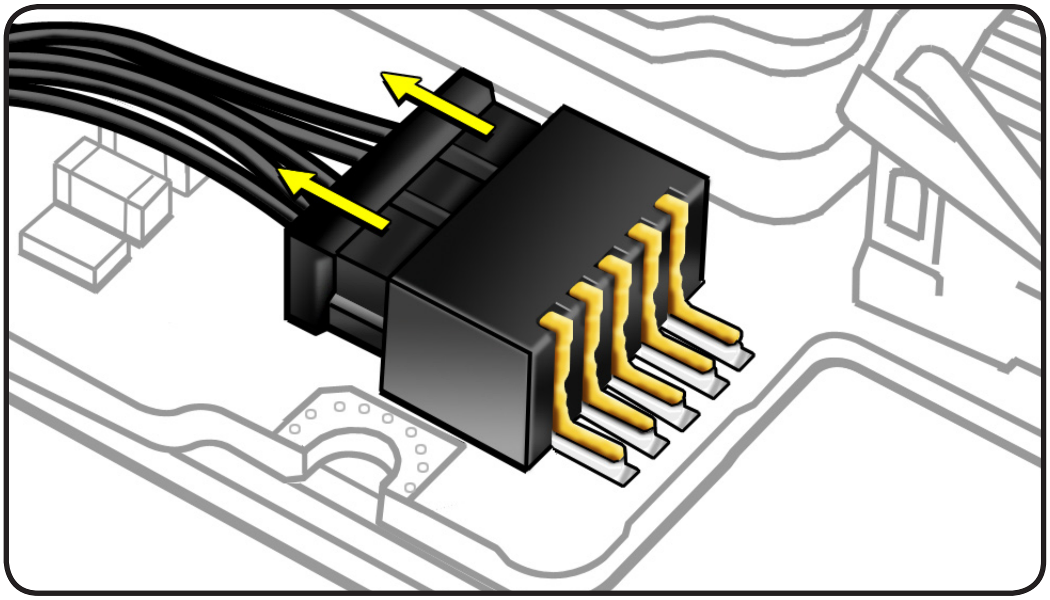
Caution: Make sure the keyboard flex cable is fully fit **all the way** into connector to prevent no power symptoms.

Horizontal Install

- Pull connector, not cable, to remove.
- Slide connector into receptacle on same horizontal plane as board.

Examples:

- MagSafe cable on underside of board
- battery power cable on underside of board

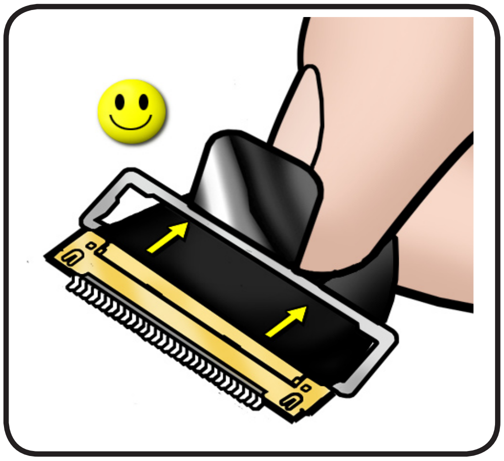


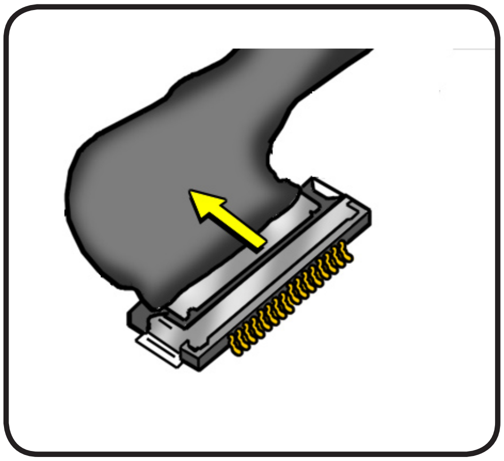
Thin, Multi-Pin Horizontal Insert

- Use fingernails or tweezers to remove evenly.
- Slide connector into receptacle on same horizontal plane as board.

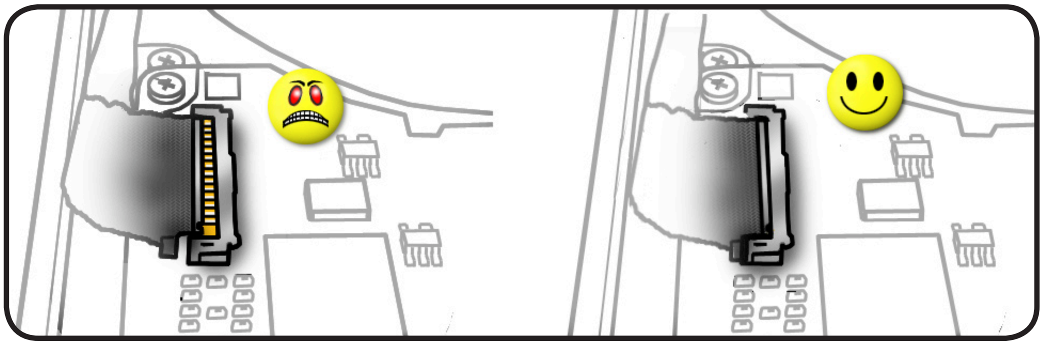
Examples shown:

- LVDS cable with lock bar
- camera cable

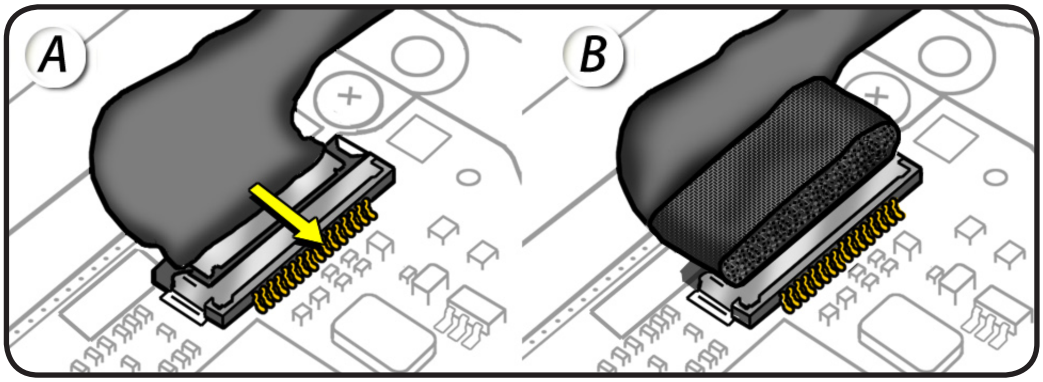




Replacement Caution: When connecting cables, make sure they are fully connected.



Replacement Caution: To avoid a short to the logic board, be sure to place EMI gasket on camera cable—positioned precisely where shown—**after** cable is fully connected to logic board.

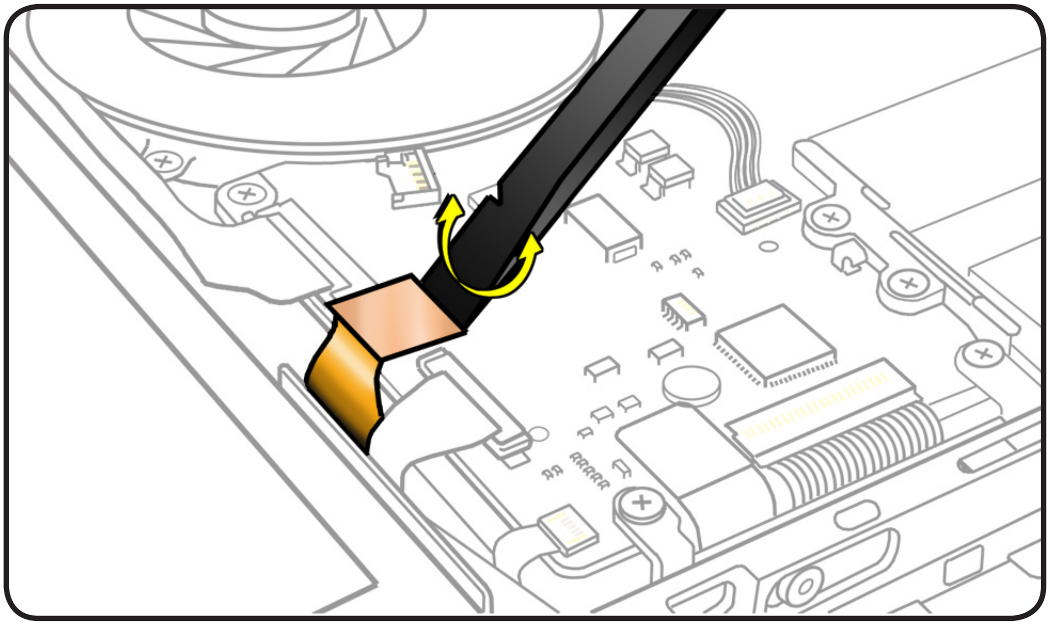


Low-Profile Solid Platform Flex

- Use black stick and gentle rocking motion to release tension to remove cable.
- Keep connector level to board and press evenly on platform to install.

Examples:

- optical drive flex cable
- trackpad flex cable
- hard drive connector cable



Icon Legend

The following icons are used in this chapter:

Icon	Meaning
⚠	Warning or Caution
✓	Check mark; make sure you do this
😡	Challenging procedure; requires more thought and/or time until you are familiar with it
🚫	Do not touch

Temperature Concerns

The normal operating temperature of this computer is well within national and international safety standards. Nevertheless, customers may be concerned about the generated heat. To prevent an unneeded repair, you can compare a customer's computer to a running model, if available, at your repair site. For more information on temperature concerns and customer perception, refer to Knowledge Base article 30612 "Apple Portables: Operating Temperature."

http://docs.info.apple.com/article.html?artnum=30612

Replacement Steps

When there are no replacement steps listed, replace parts in the exact reverse order of the Removal procedure.

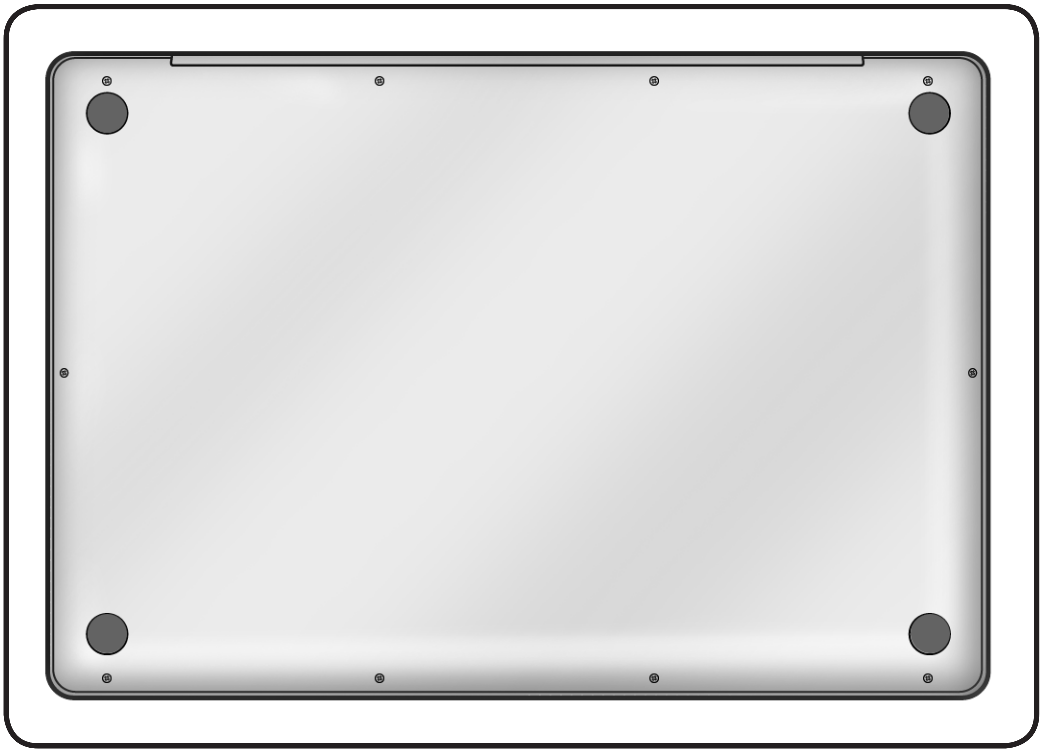
Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.

Bottom Case

First Steps

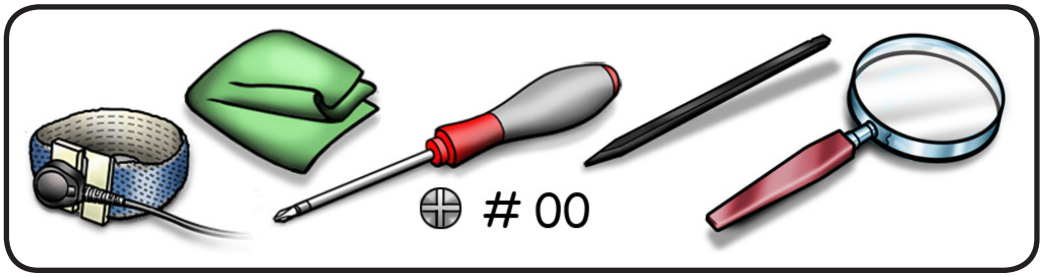
Warning:
- Shut down computer.
- Wait 10 minutes
- Unplug all cables.
- Put on ESD strap.



Tools

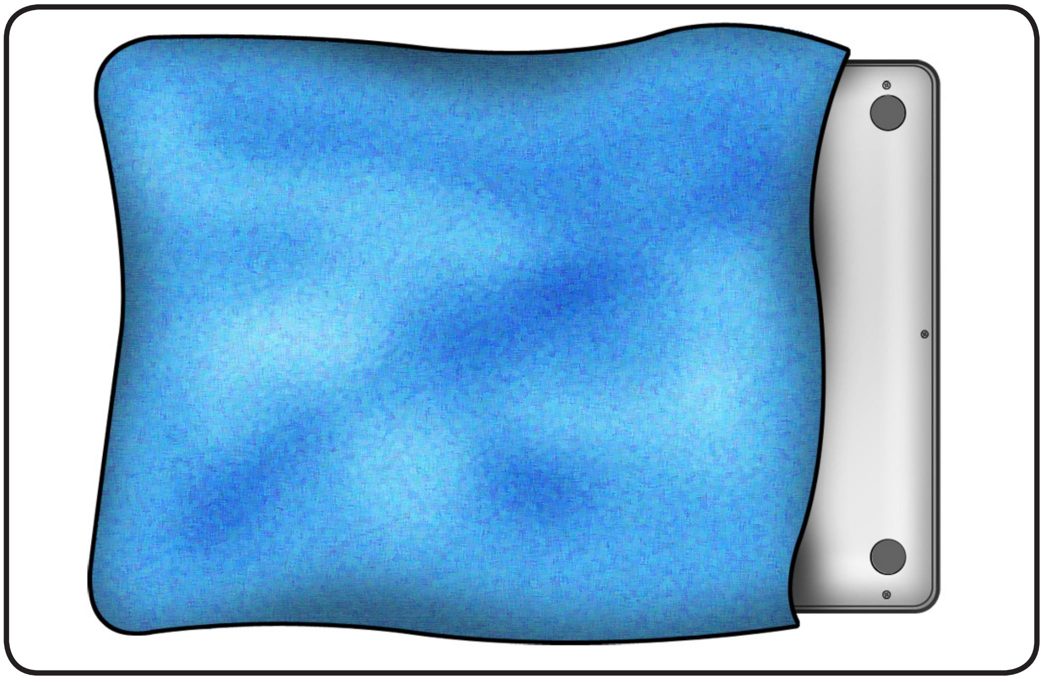
Clean, soft, lint-free cloth

- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick
- Magnifying glass

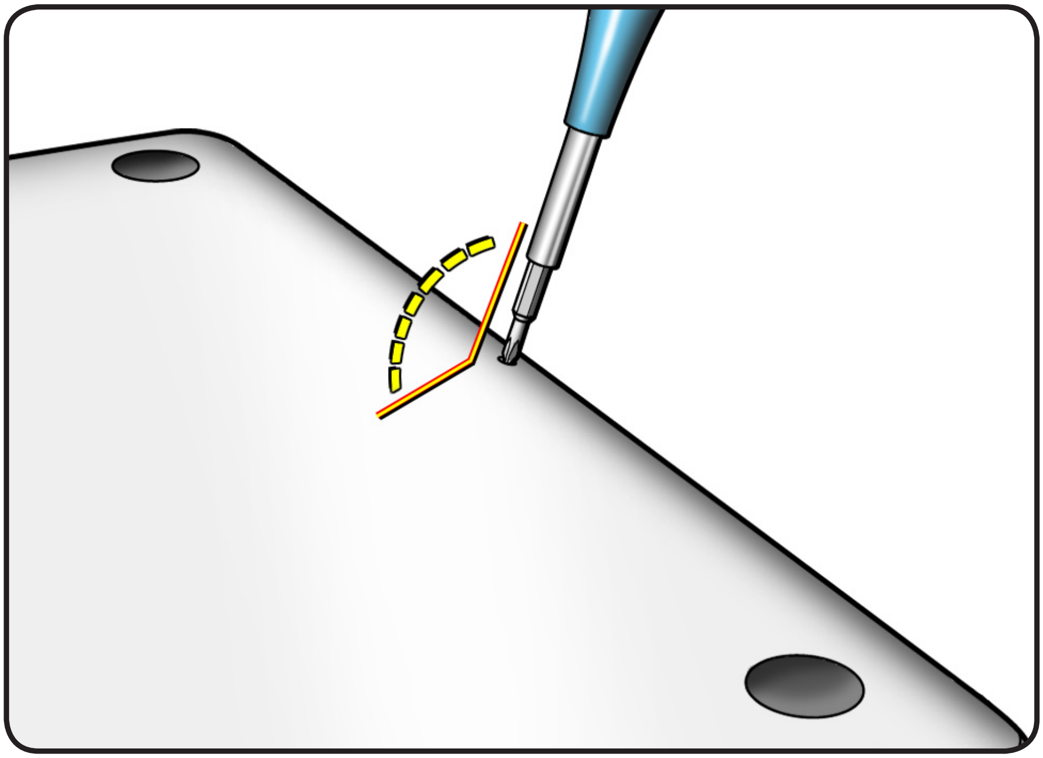


Removal

Caution: To prevent scratches, use a protective cloth when working with metal tools.



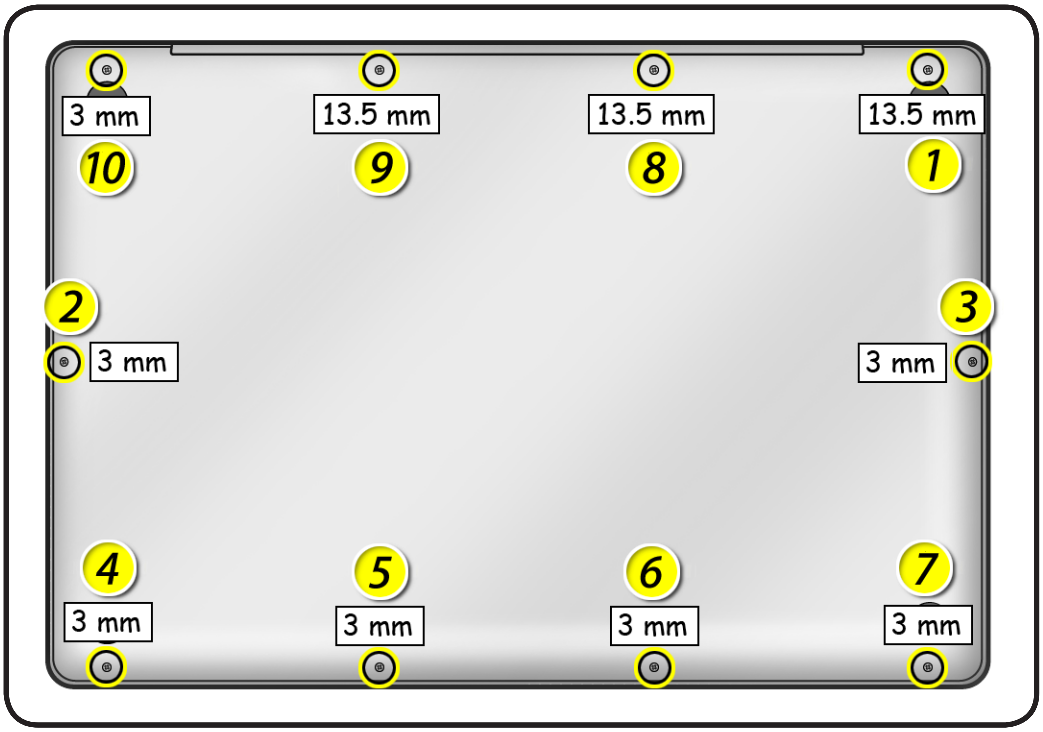
1 **Important:** The screws at the sides and front of the computer must be removed and installed at an angle.



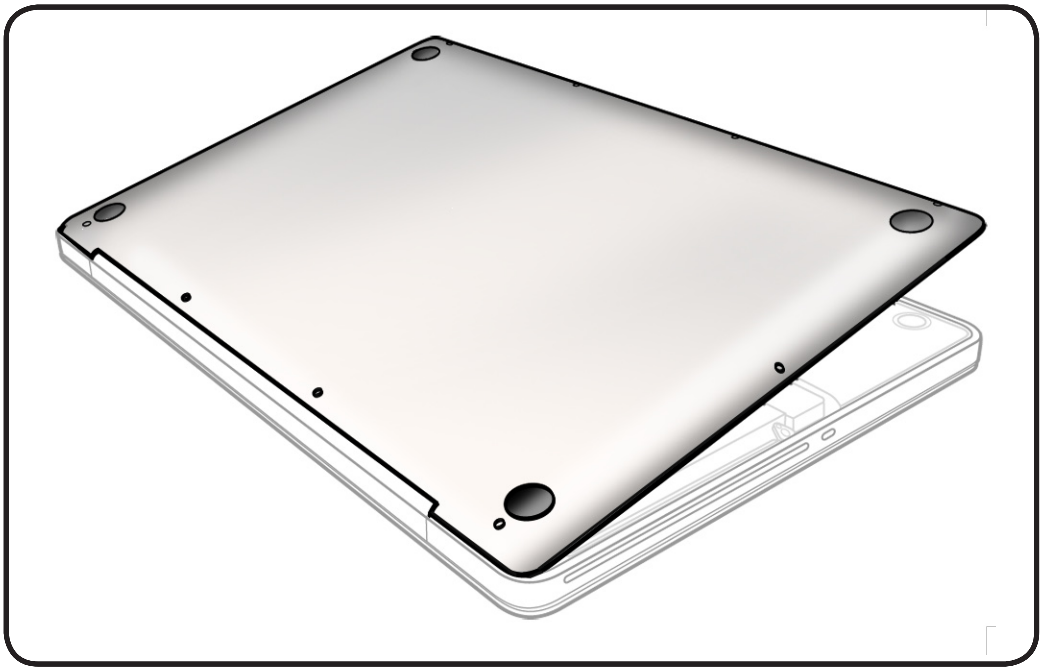
2 Remove 10 screws:

- 3 (13.5 mm) 922-8985
- 7 (3 mm) 922-8986

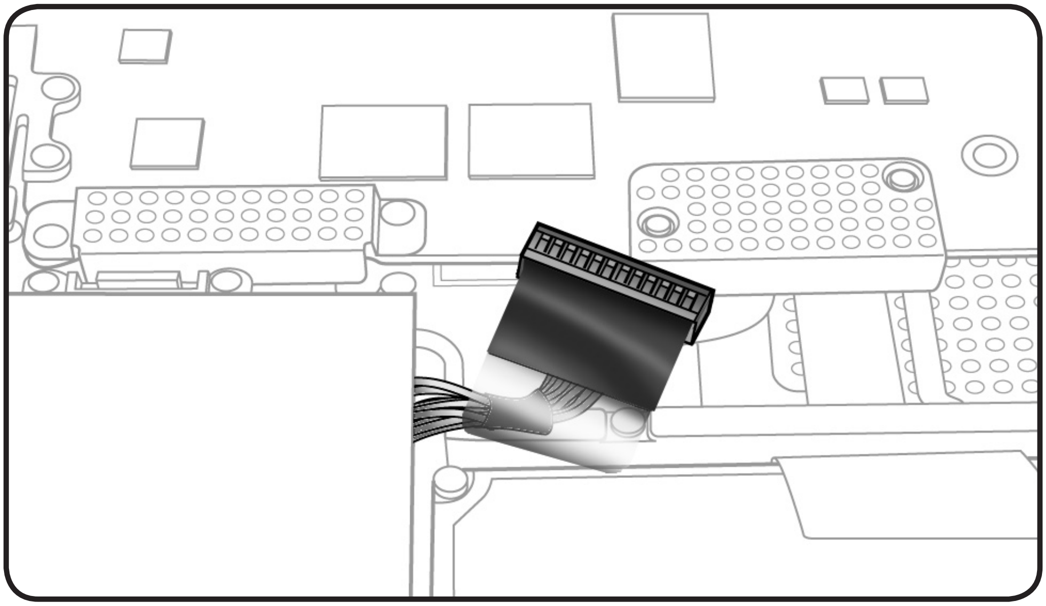
Replacement Note: Install screws in the order shown.


3 mm
10
13.5 mm
9
13.5 mm
8
13.5 mm
1
2
3 mm
3
3 mm
4
3 mm
5
3 mm
6
3 mm
7
3 mm

3 Use black stick to loosen and remove bottom case.

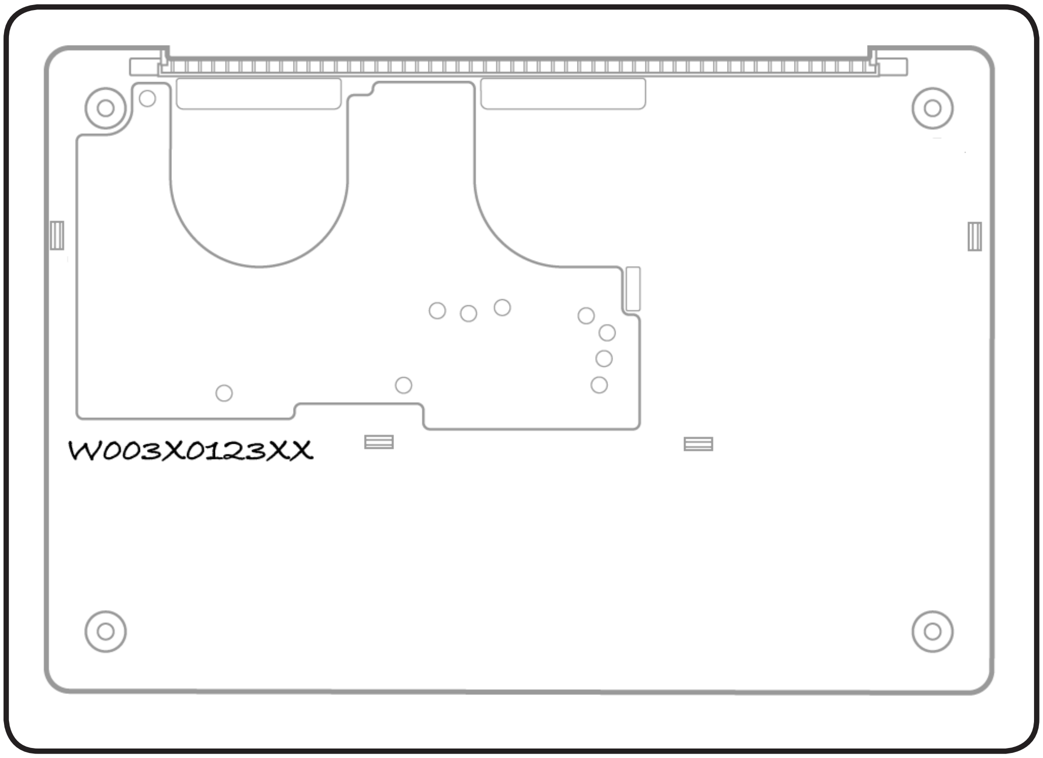


4 **Warning:** If performing any other repairs, be sure to disconnect the battery cable by its pull-tab.

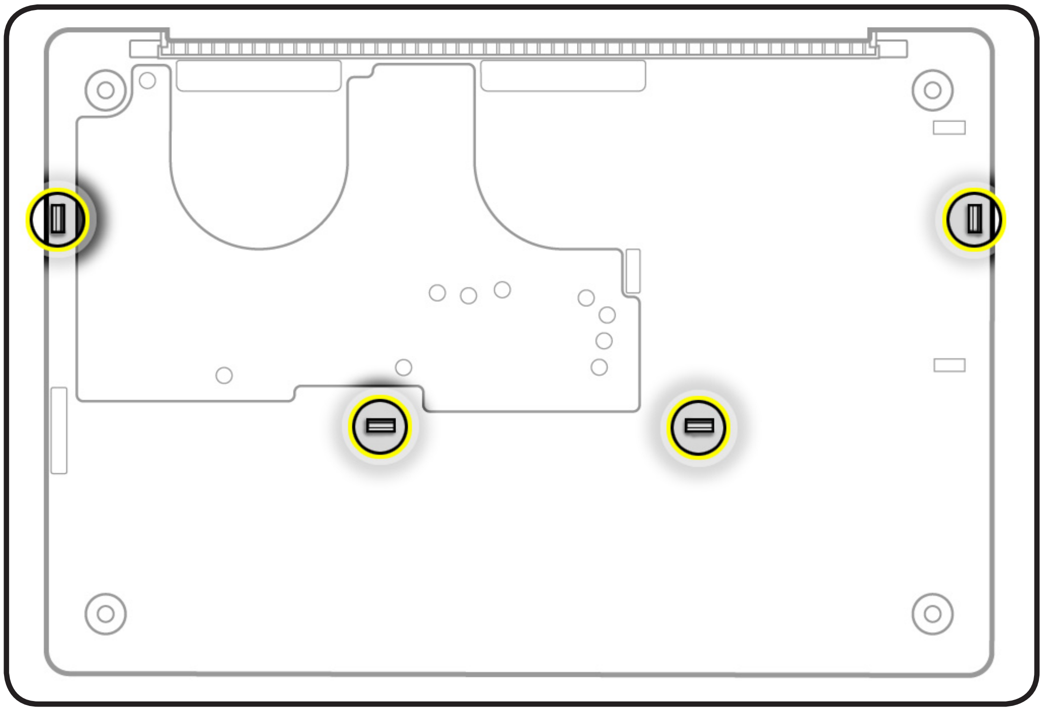


Replacement

1 When replacing a bottom case, retain the customer's bottom case until the repair is complete. Before installing the replacement bottom case, write the serial number on the inside of the new bottom case. You might need a magnifying glass to read it. Refer to Transferring the Serial Number.



2 Install bottom case so that 4 clips snap onto top case.



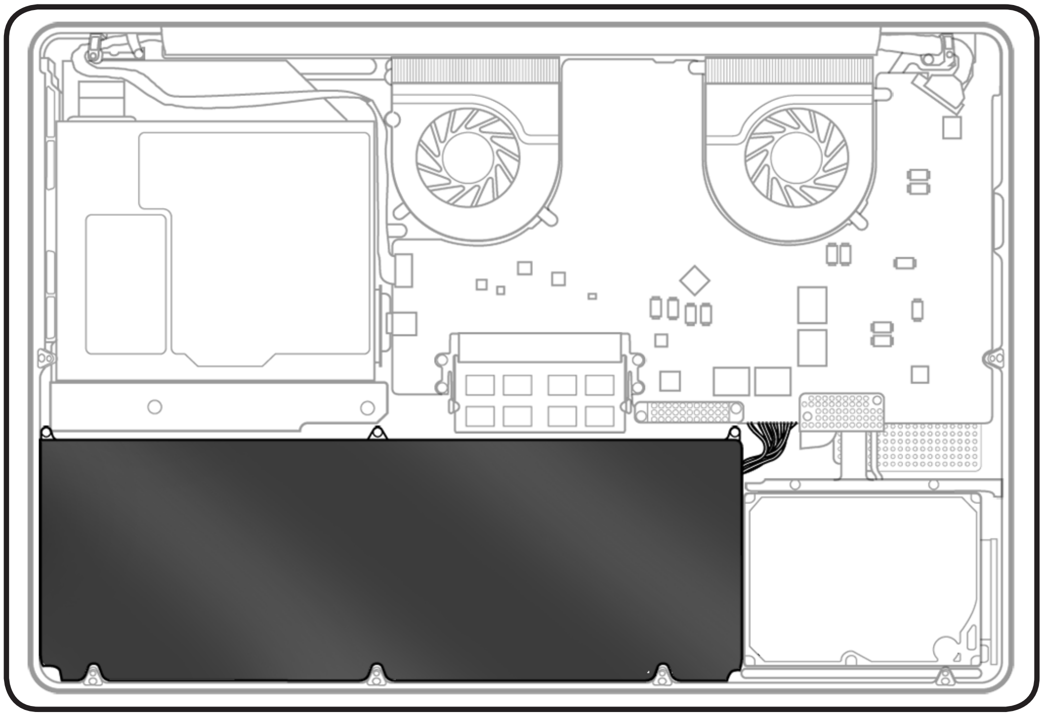
Battery

First Steps

Remove:

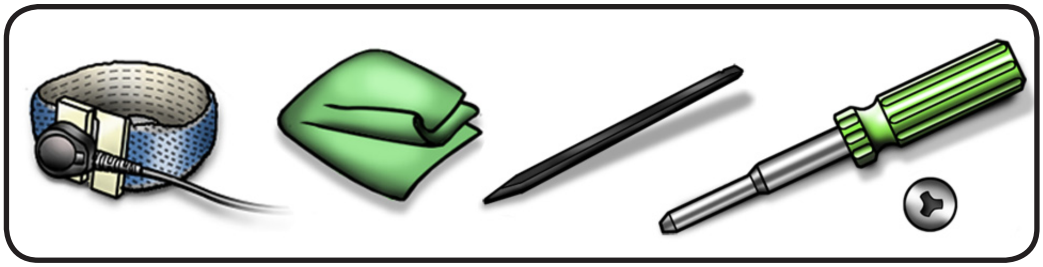
- **Bottom case**

Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

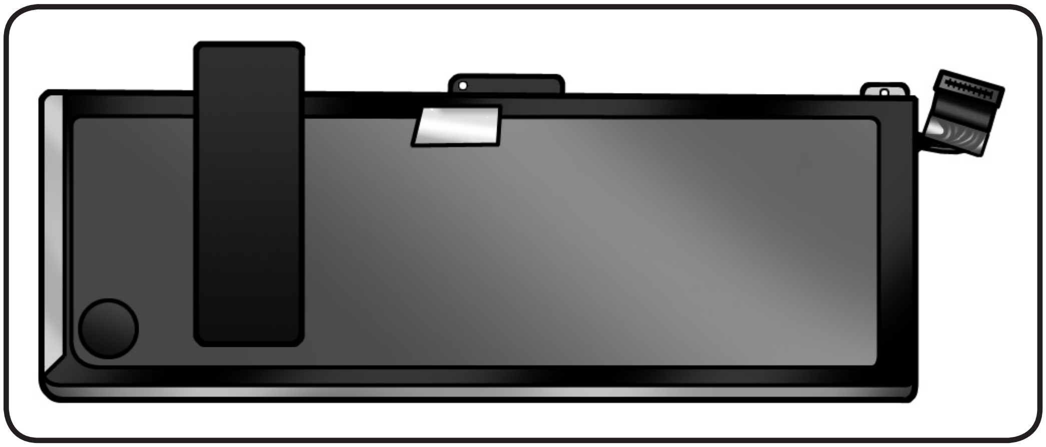
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Tri-lobe screwdriver or 3/32 (2.3-mm) flat blade jeweler's screwdriver



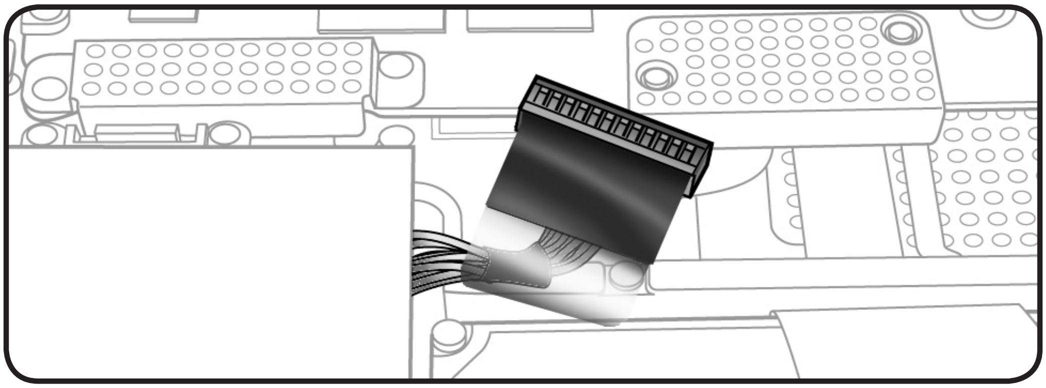
Removal

Important: Battery removal is only required when replacing the battery or the top case. Other internal repairs require disconnecting the battery cable but not removing the battery.

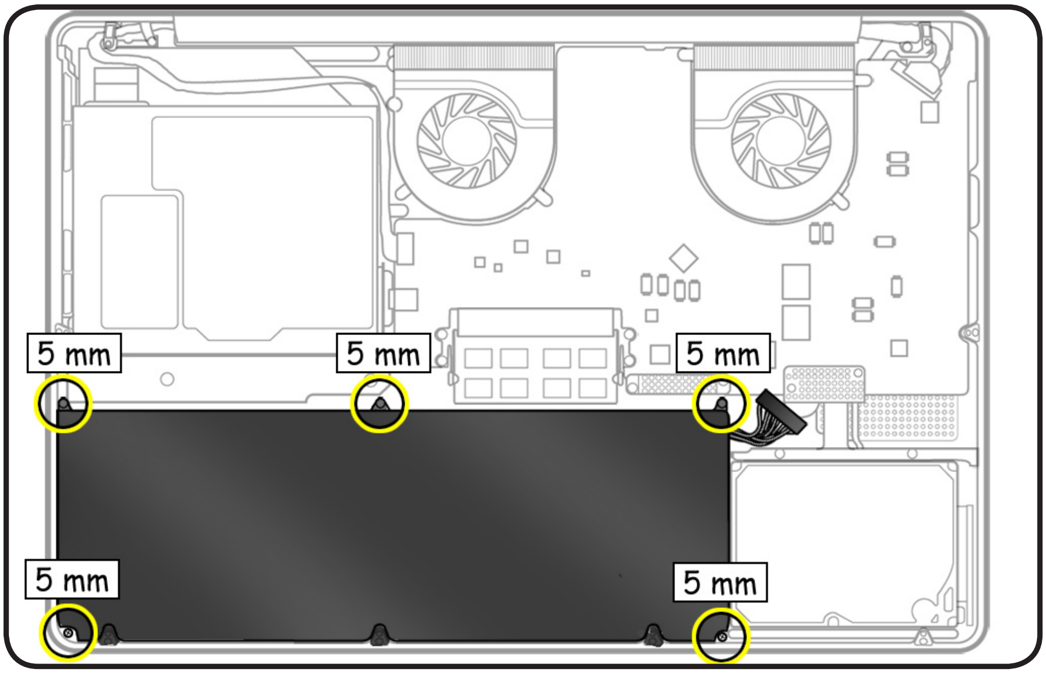
✓



1 Use pull-tab to disconnect battery cable.

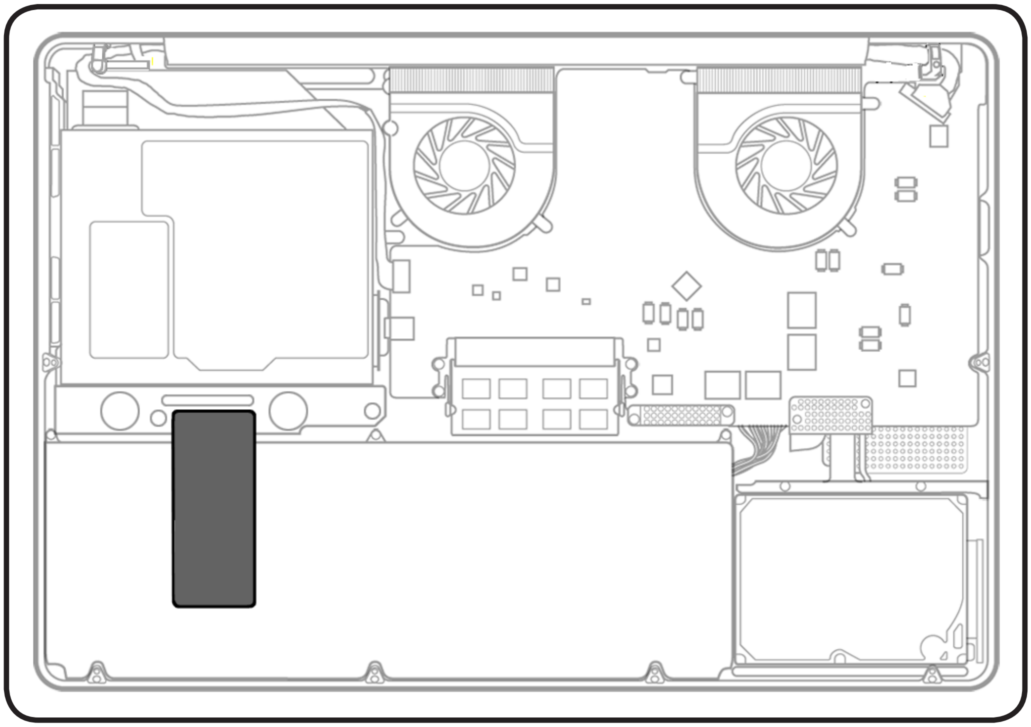


2 Remove 5 (5-mm) tri-lobe 922-8987 screws.



3 Peel up battery label, and discard it.

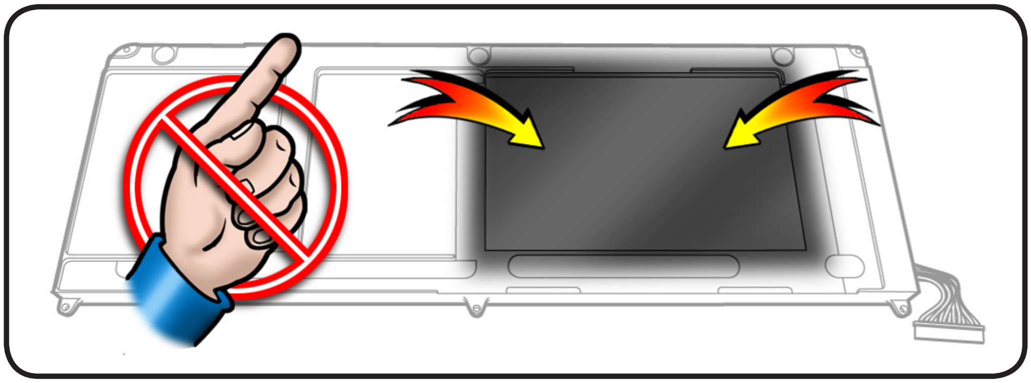
4 Remove any label residue from speaker, and from battery if it is to be reused.



5 Without pulling cable, tilt out battery.

Warning: Underside of battery is soft. Do not puncture or press on battery. Hold battery by edges only.

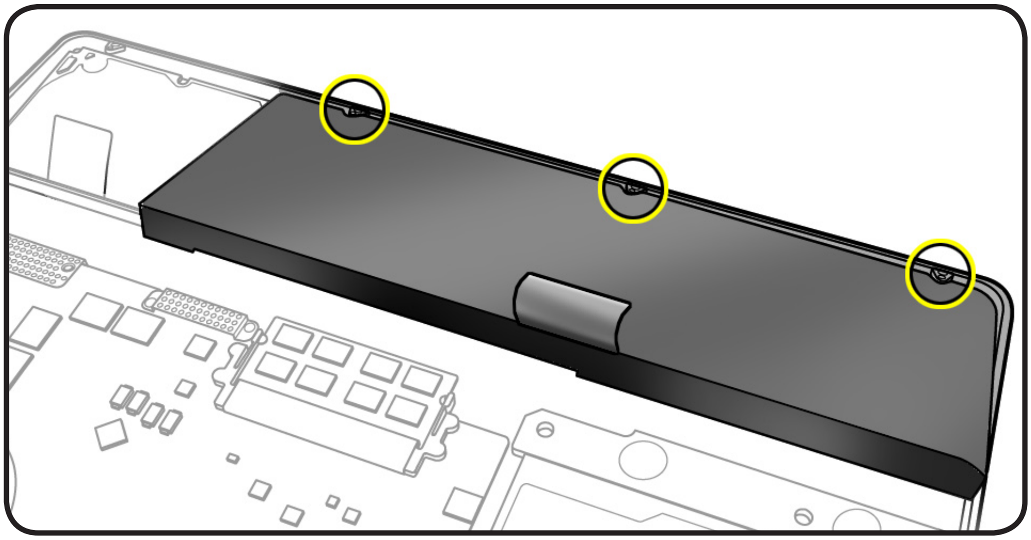
Warning: If mylar covering battery is punctured, do not re-use battery.



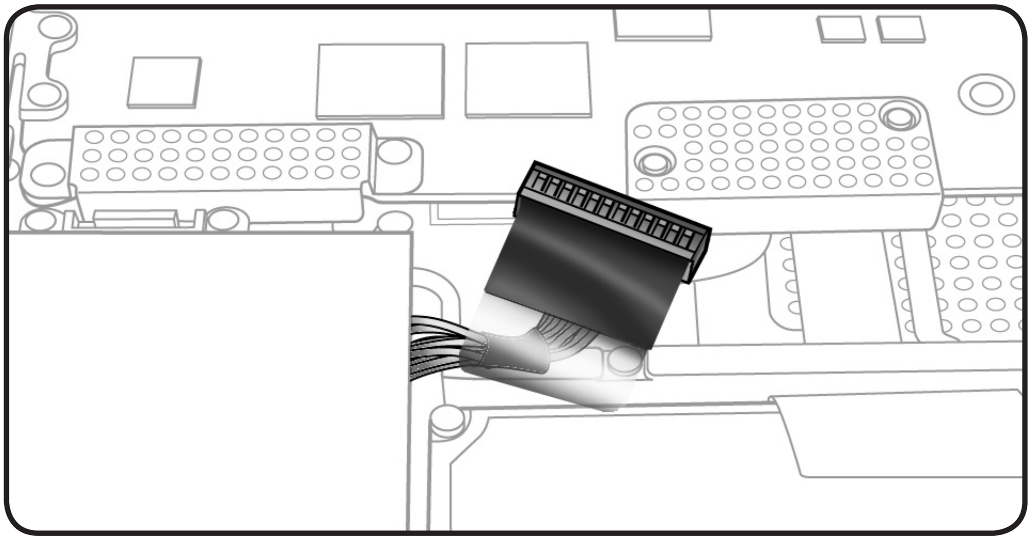
Replacement

1 Slide front edge of battery under 3 tabs.

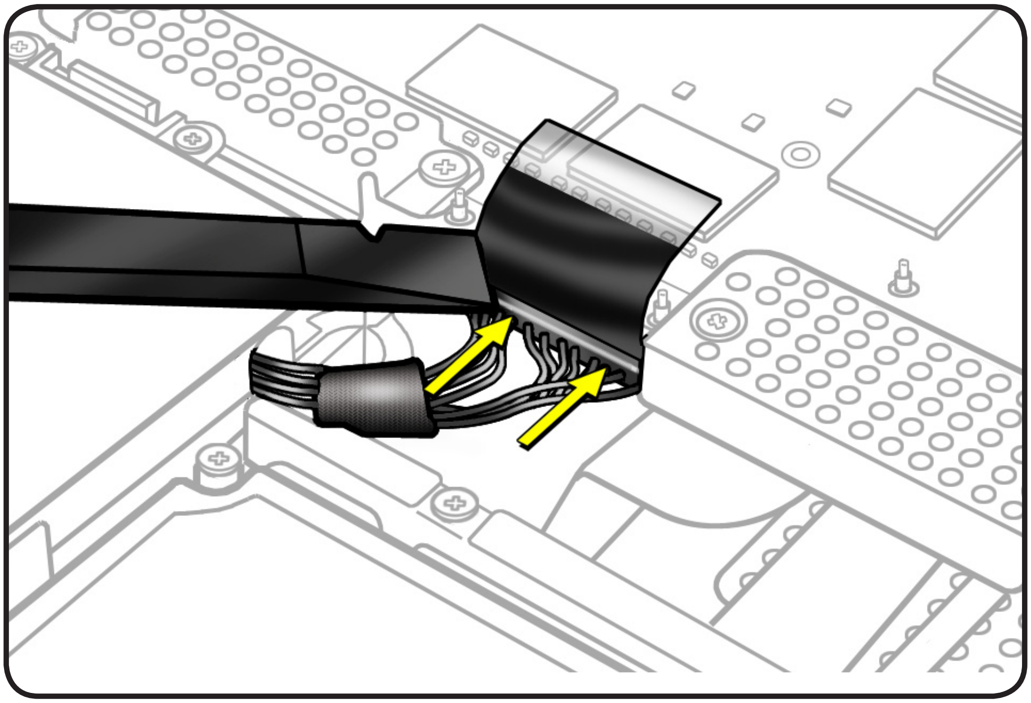
2 Install 5 screws.



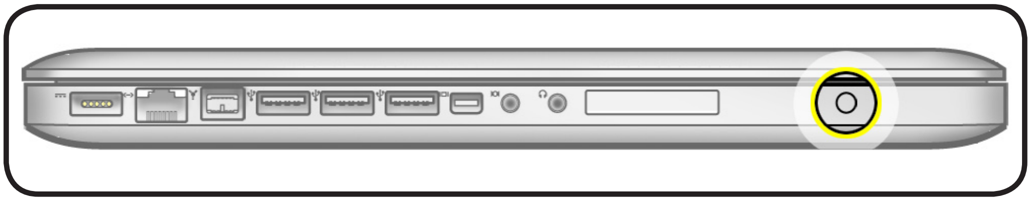
3 If performing other repairs, be sure to leave battery cable disconnected.



4 Connect battery cable using black stick or pull-tab, apply new battery label, and reassemble computer.



5 Press battery indicator light to check charge level.



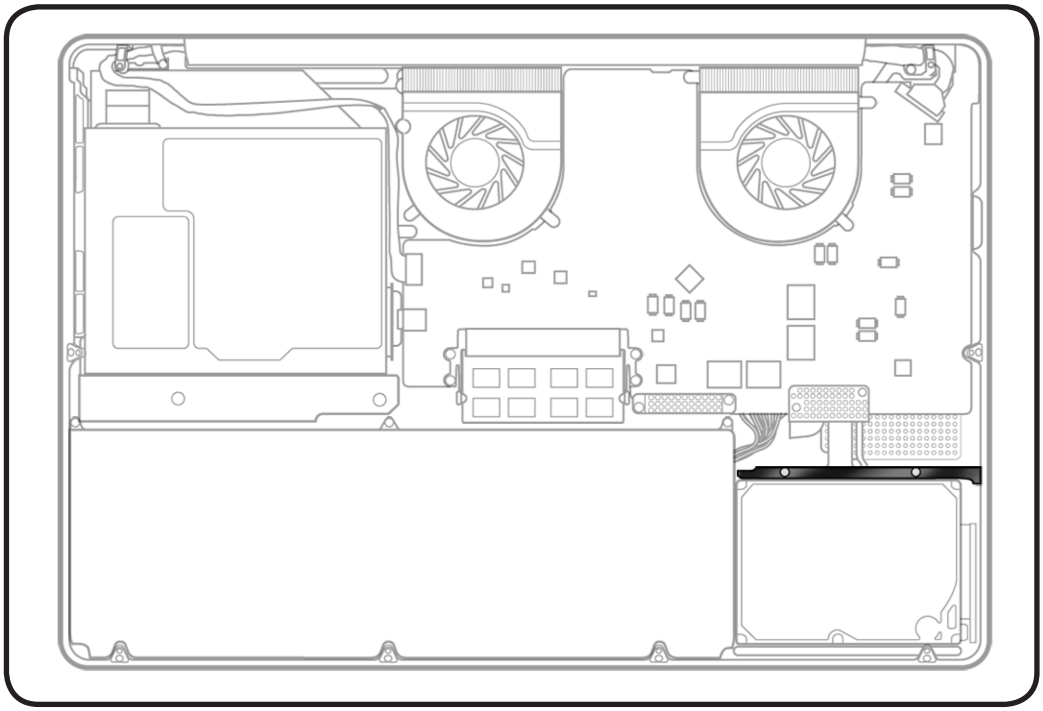
Hard Drive Bracket

First Steps

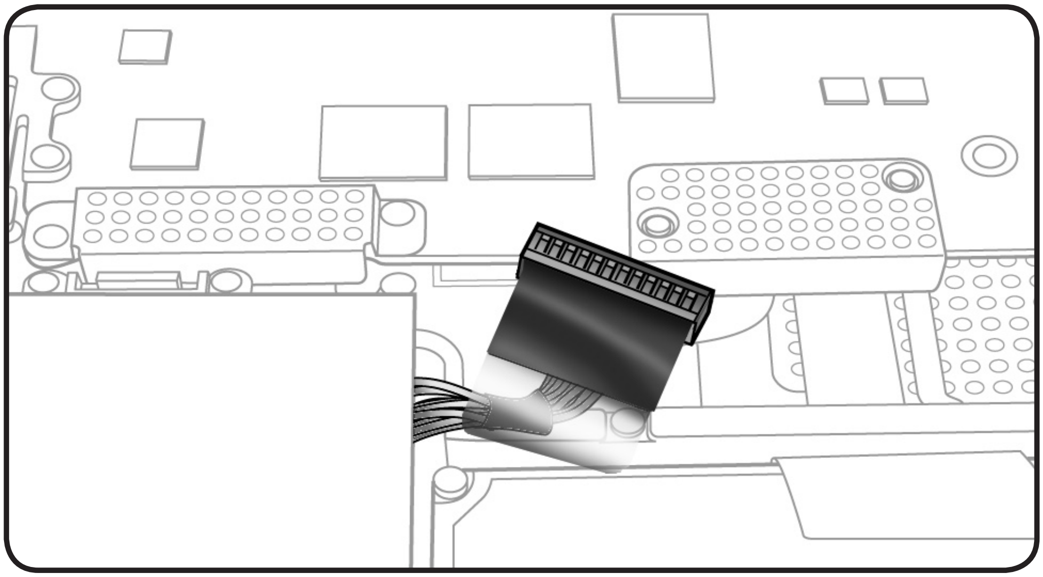
Remove:

- Bottom case

Caution: Make sure data is backed up before removing the hard drive.



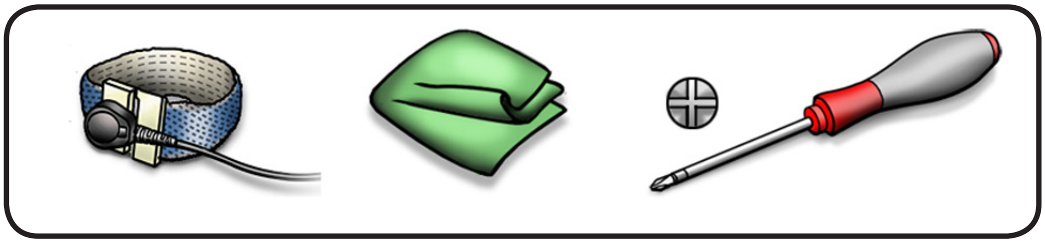
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

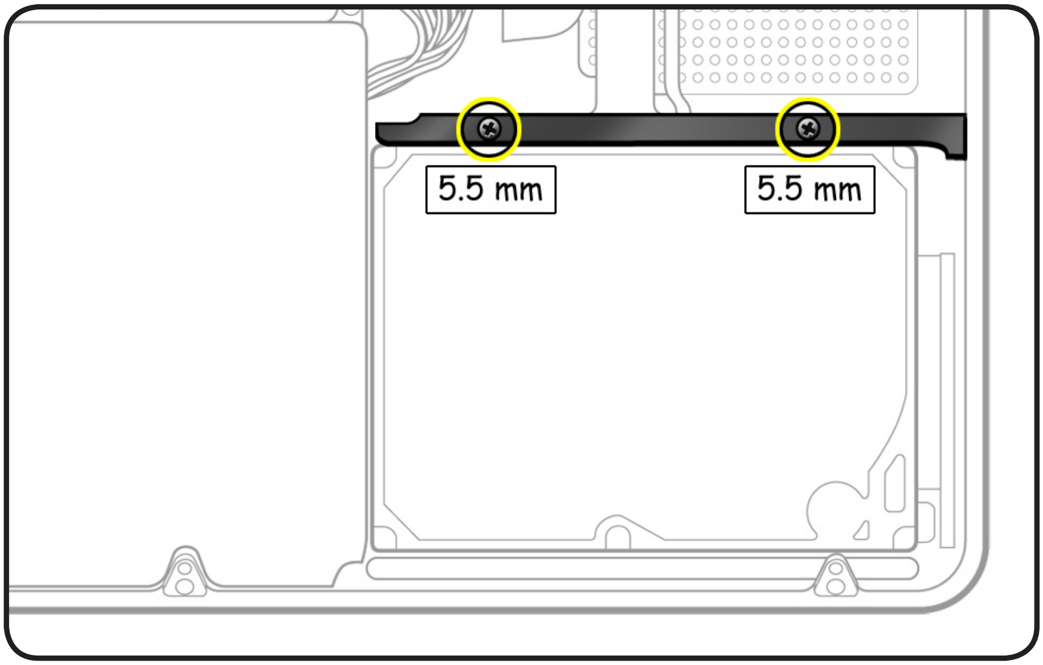
Clean, soft, lint-free cloth

- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



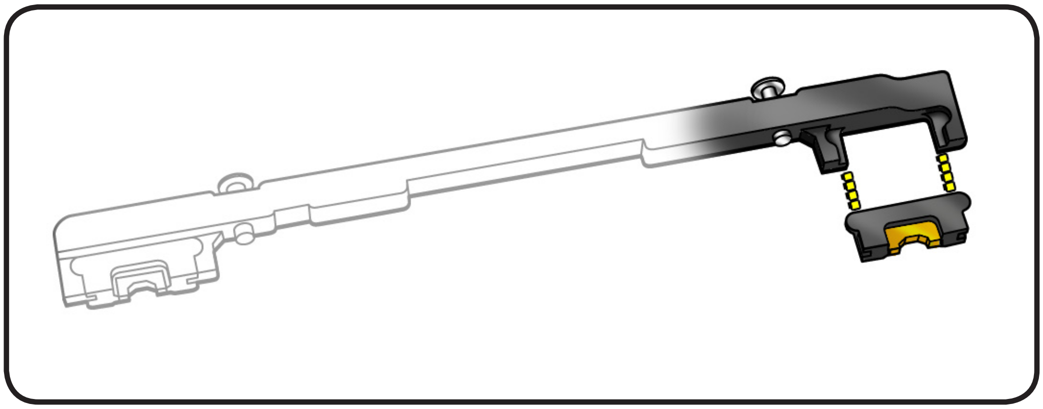
Removal

1 Loosen 2 (5.5 mm) 922-xxxx captive screws.



2 Lift out bracket.

Replacement Note: Make sure 2 rubber grommets are included in bracket before installing it.



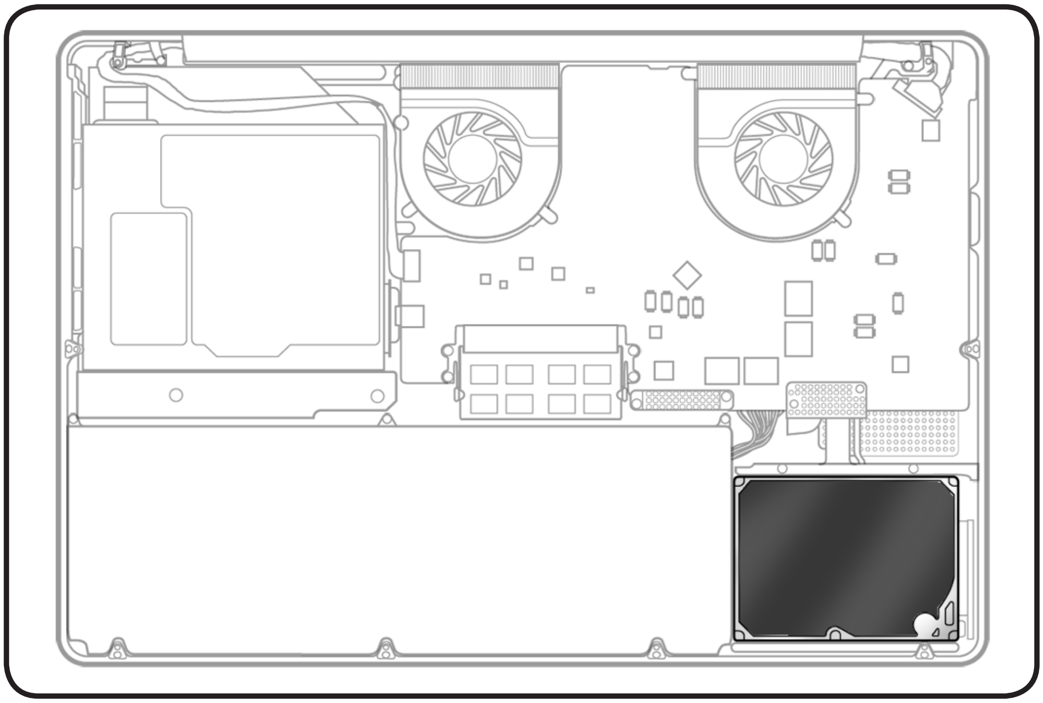
Hard Drive

First Steps

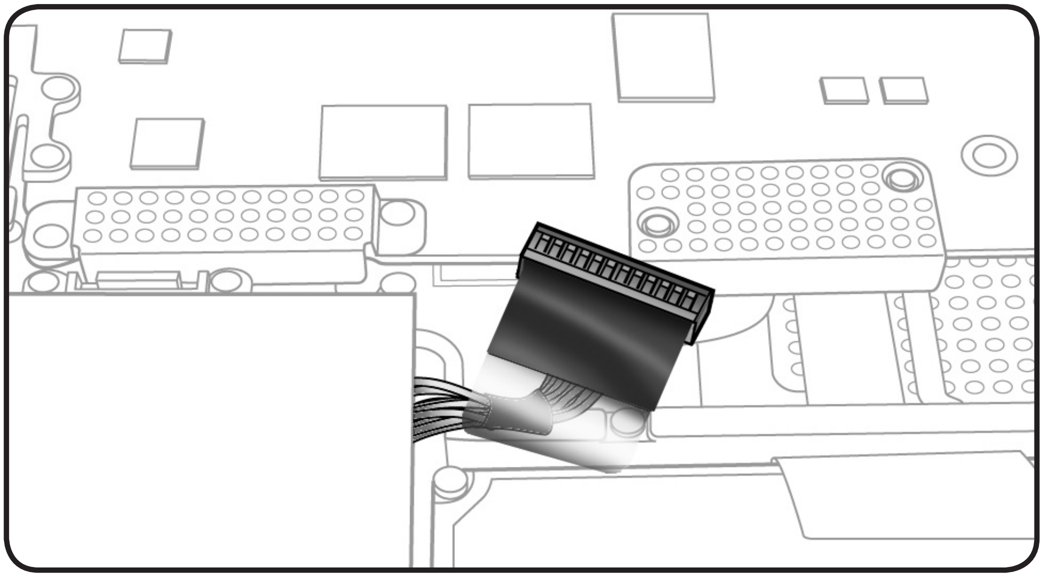
Remove:

- Bottom case
- Hard drive bracket

Caution: Make sure data is backed up before removing the hard drive.

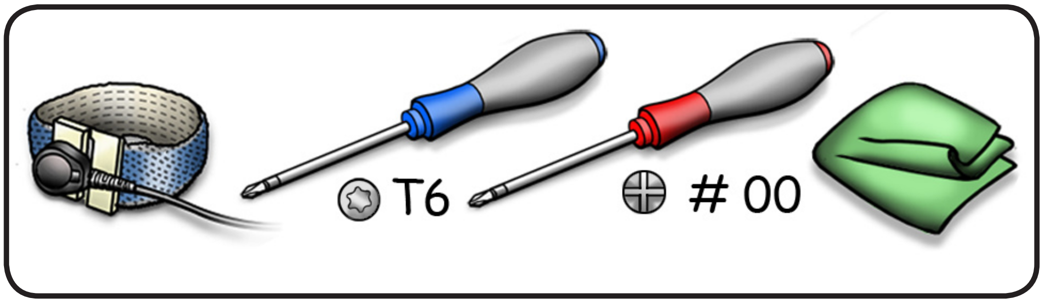


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

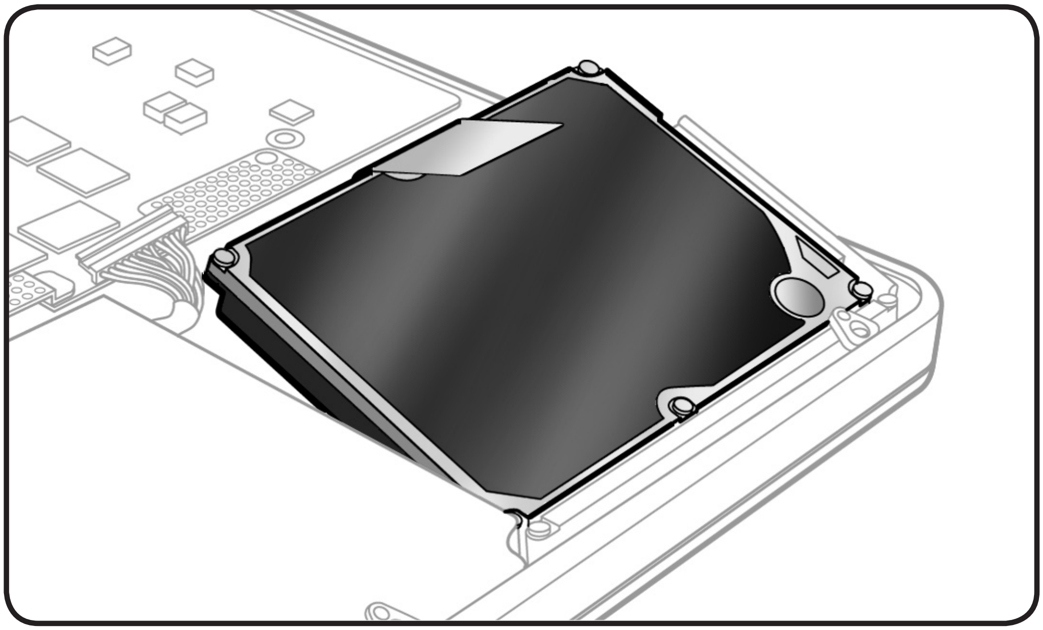
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Torx T6 screwdriver



Removal

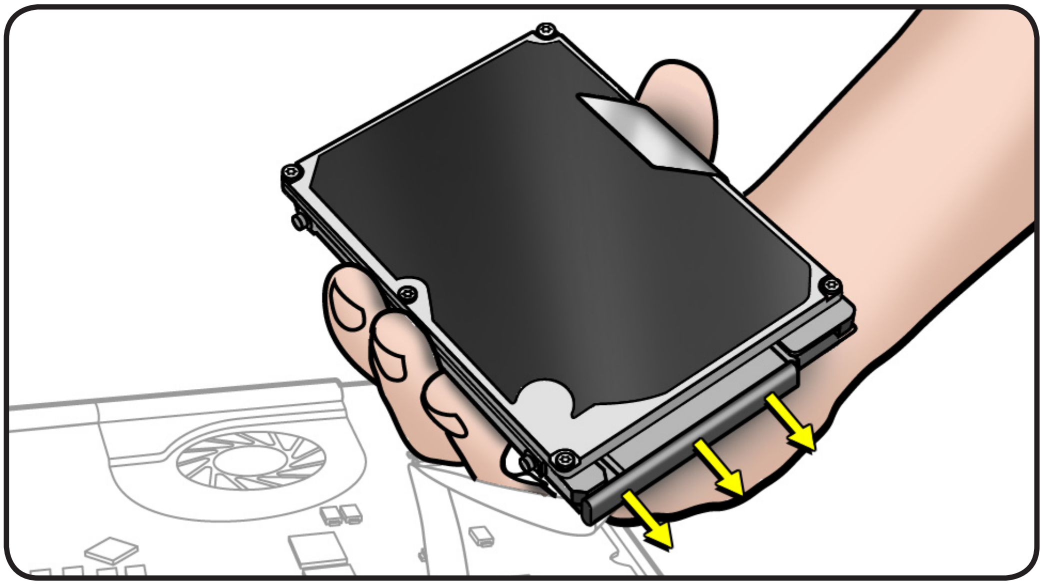
1. Make sure hard drive bracket is removed.

2. Use pull tab to tilt hard drive out.



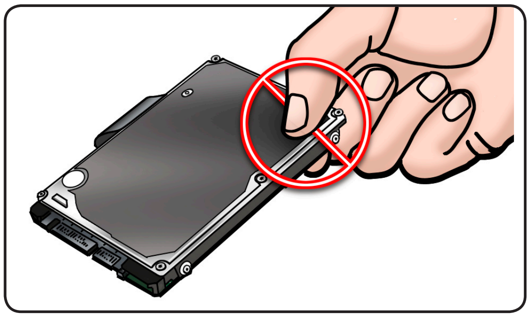
3 Hold hard drive by the sides only.

4 Disconnect hard drive connector.

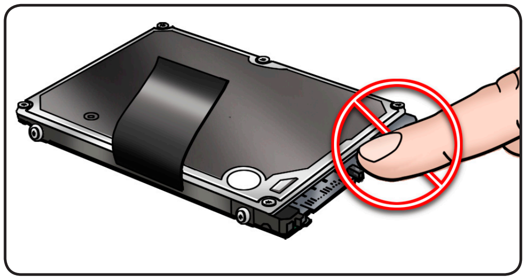


5 Follow safe handling:

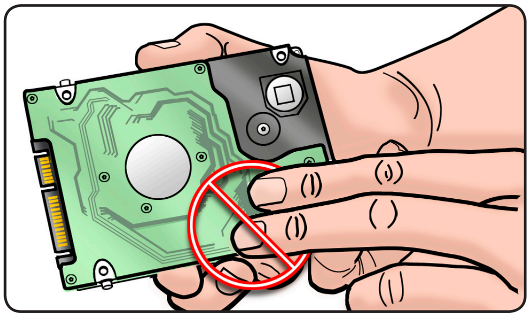
- Do not press drive



- Do not touch connector

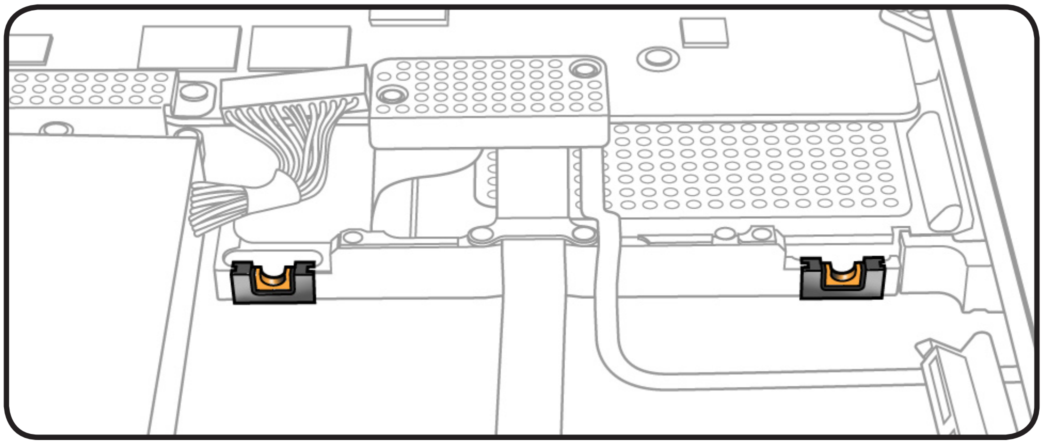


- Do not touch circuitry



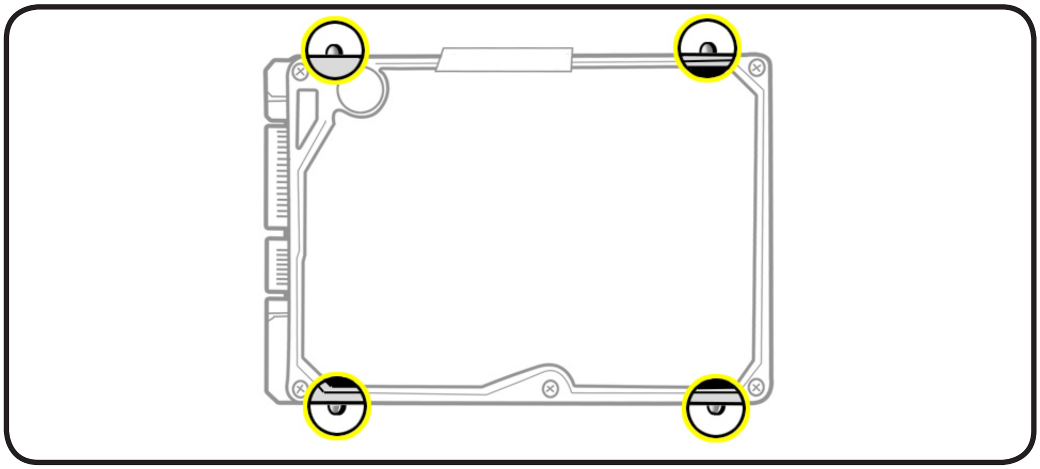
Replacement

1 Make sure rubber grommets are included in top case before installing the hard drive.

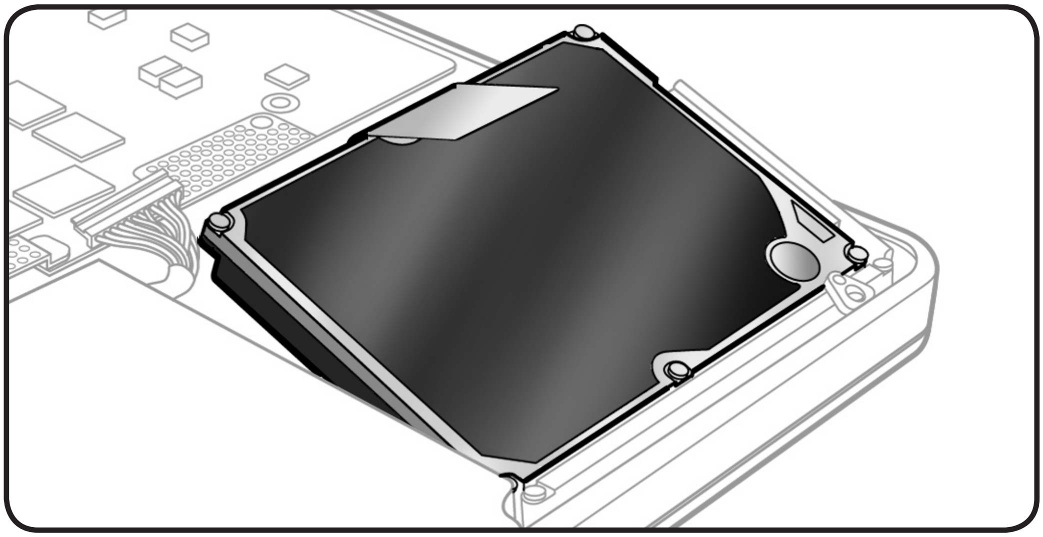


2 Make sure 4 Torx T6 (922-xxxx) mounting screws are installed on drive.

If replacement drive does not have mounting screws, transfer them from the old drive.



3 Attach connector, and tilt hard drive into front of top case.



Reinstalling Software that Came with the Computer

Use the software install discs that came with the computer to reinstall Mac OS X and any applications that came with the computer. Choose either "Archive and Install," which saves the existing files and settings, or "Erase and Install," which erases all the data.

Important: Apple recommends backing up data on the hard disk before restoring software. Because the "Erase and Install" option erases the hard disk, you should back up essential files before installing Mac OS X and other applications. Apple is not responsible for any lost data.

Installing Mac OS X

To install Mac OS X, follow these steps:

1. Back up essential files.
2. Make sure power adapter is connected and plugged in.
3. Insert the Mac OS X Install DVD that came with the computer.
4. Double-click Install Mac OS X.
5. Follow the onscreen instructions.

   Note: To restore Mac OS X on the computer to the original factory settings, click Options in the "Select a Destination" pane of the Installer, and then select "Erase and Install." If you choose "Erase and Install," you will see a message reminding you to use the Applications Install DVD to reinstall the bundled applications that came with the computer.
6. Whent the installation is complete, click Restart.
7. Follow the prompts in the Setup Assistant to set up the user account.

Installing Applications

If you reinstall Mac OS X on the computer and select the "Erase and Install" option, you must reinstall the applications that came with the computer, such as the iLife applications.

To install applications that came with the computer, follow these steps:

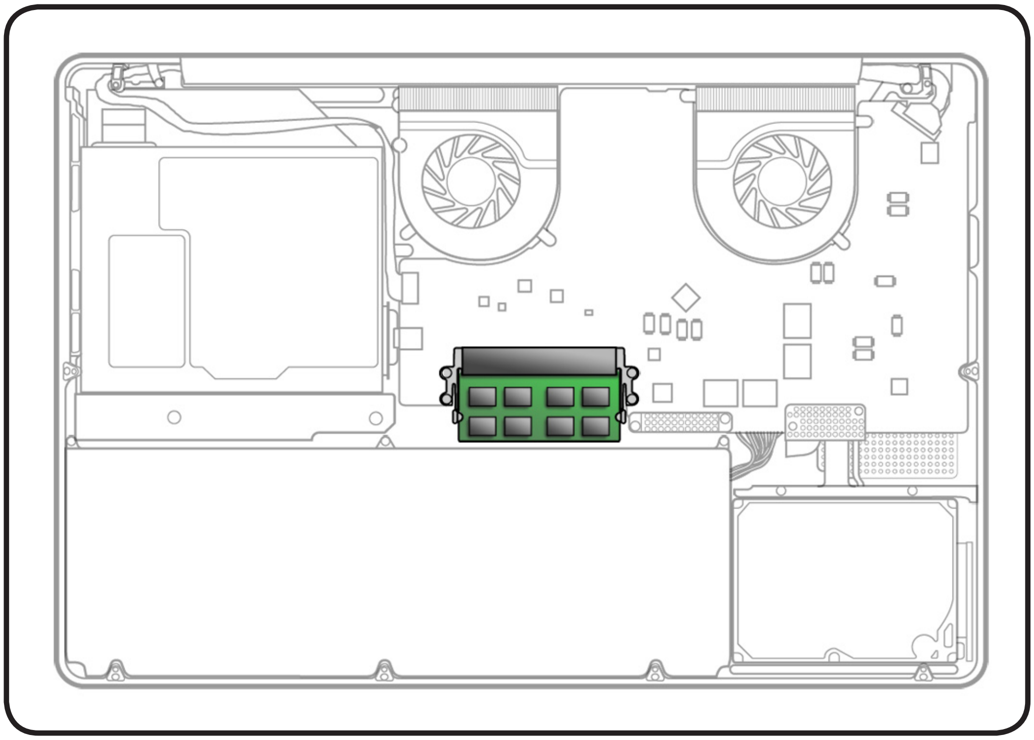
1. Make sure power adapter is connected and plugged in.
2. Insert the Applications Install DVD that came with the computer.
3. Double-click Install Bundled Software.
4. Follow the onscreen instructions.
5. When the installation is complete, click Close.

Memory

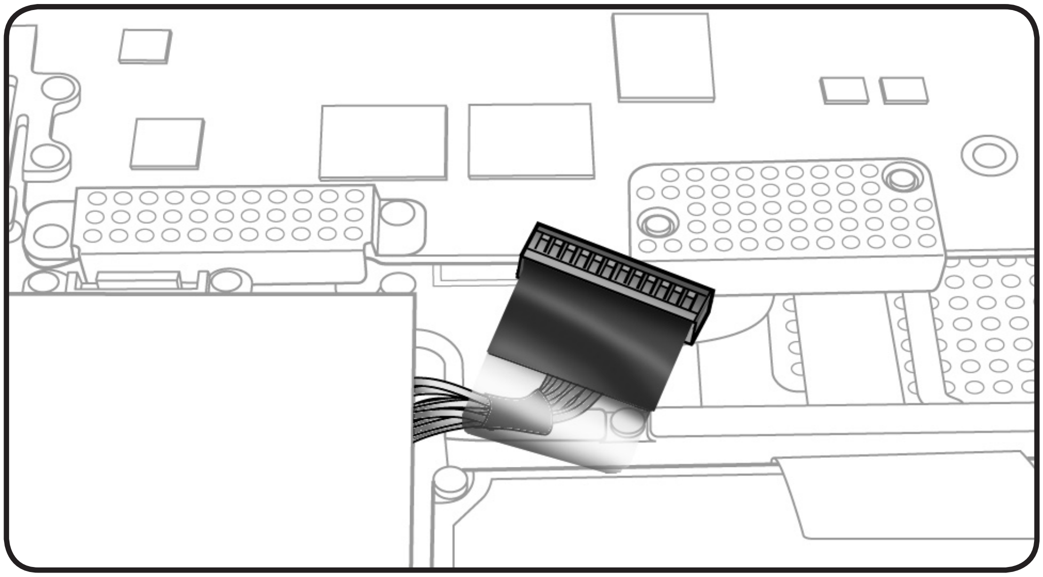
First Steps

Remove:

- **Bottom case**

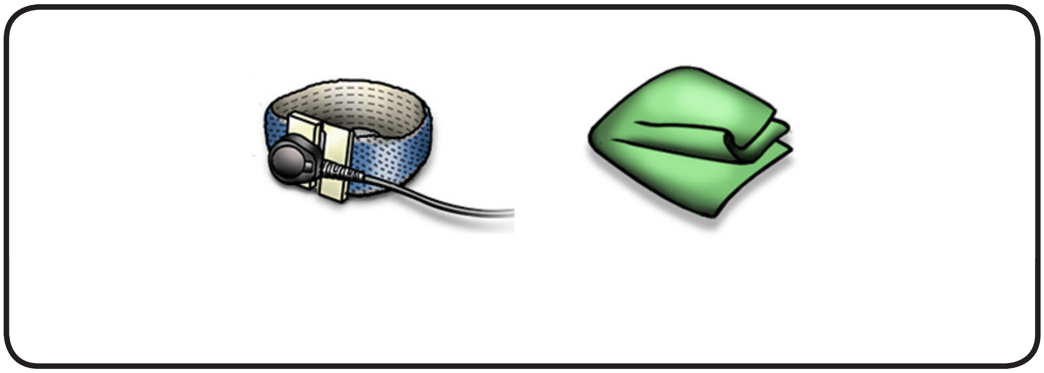


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat



Removal

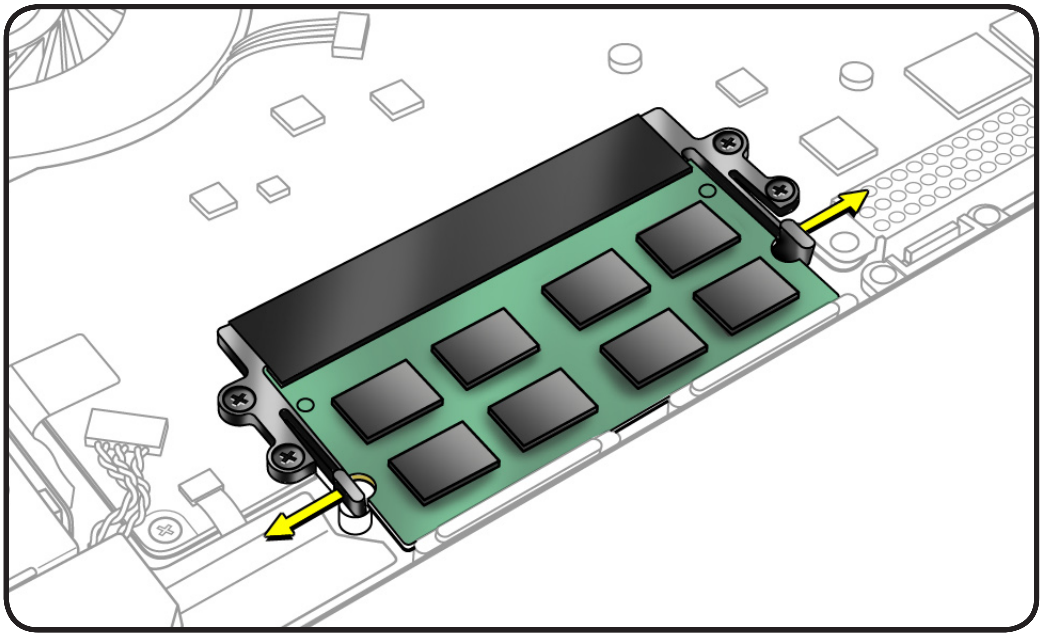
Memory cards must be:

- 1.25 inch (3.18 cm) or smaller
- 2 GB or 4 GB
- 200-pin
- PC3-8500 DDR3, 1066 MHz RAM

This computer comes with a minimum of 2 GB of 1066 MHz Double Data Rate 3 (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. It has two slots that can accept SDRAM Small Outline Dual Inline Memory Modules (SO-DIMMs). The slots are stacked on the logic board under the bottom case. For best performance, memory should be installed as pairs with an identical memory card in each slot. The maximum amount of memory for this computer is 8 GB, with a 4 GB DIMM installed in each slot.

1 Press out 2 ejection levers until the card tilts up completely,

The card tilts up at an angle. Before removing the card, make sure you see the half- circle notches. If not, press the ejection levers again.

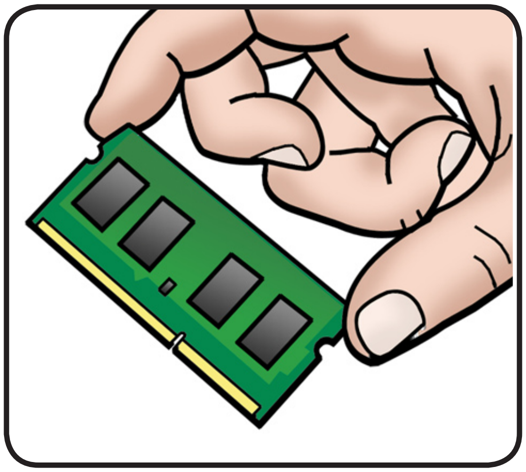


2 Pull out the card.

3 Hold the card by the edges.

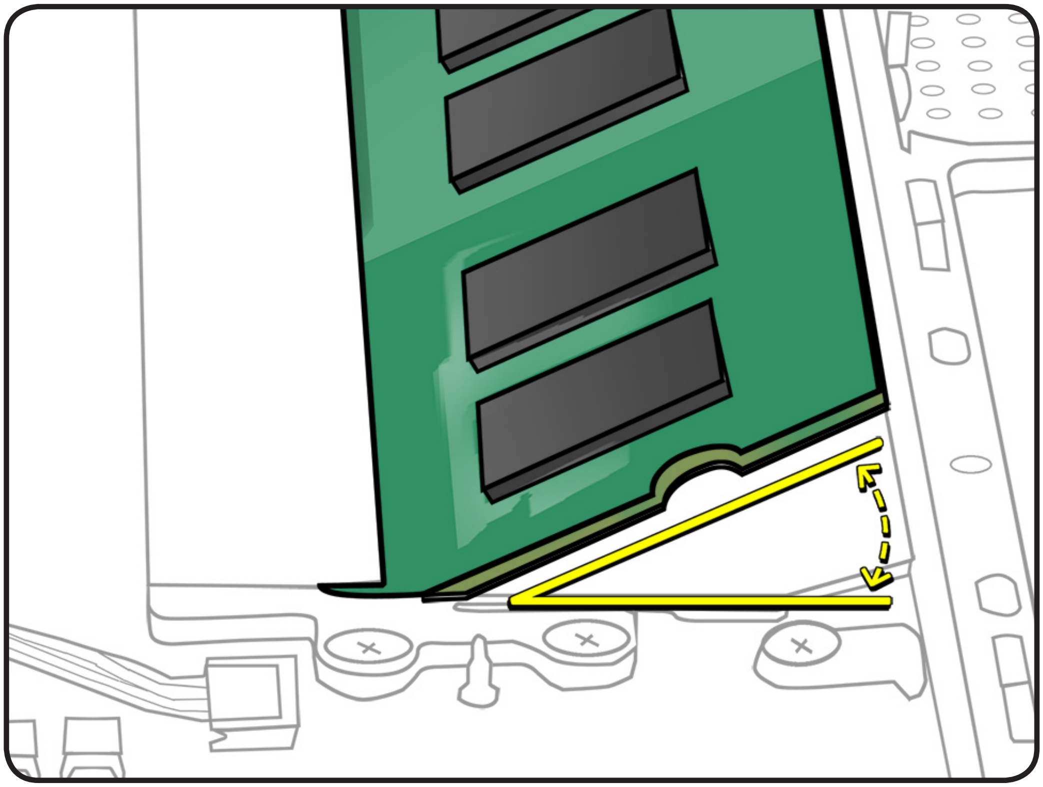
4 Do not touch the gold connectors.

Note: New memory cards might have a harmless white residue on the gold connectors.



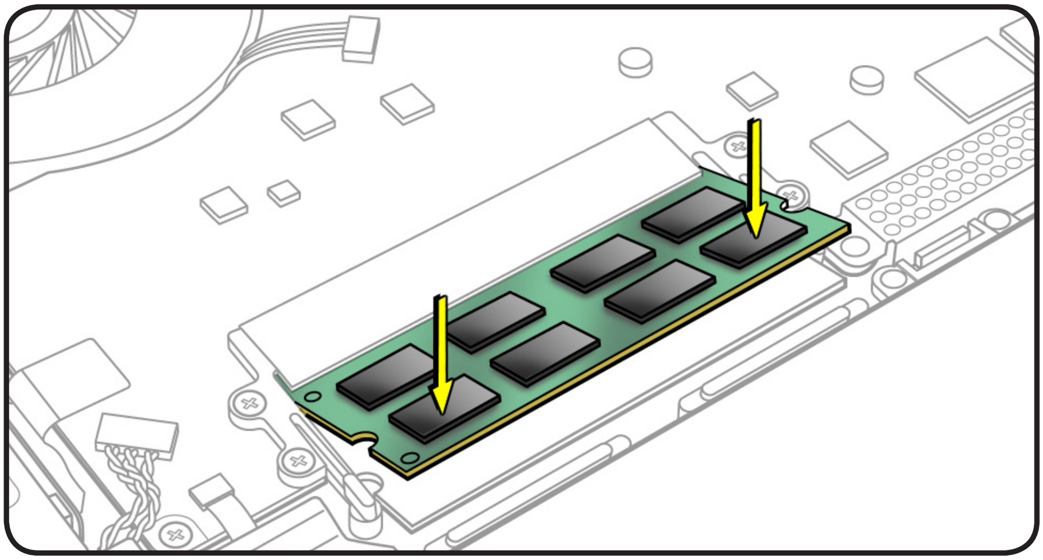
Replacement

1 Install cards at an angle. If installing just one card, install it in lower slot.



2 Press card down.

3 If you installed additional memory, check that computer recognizes it.

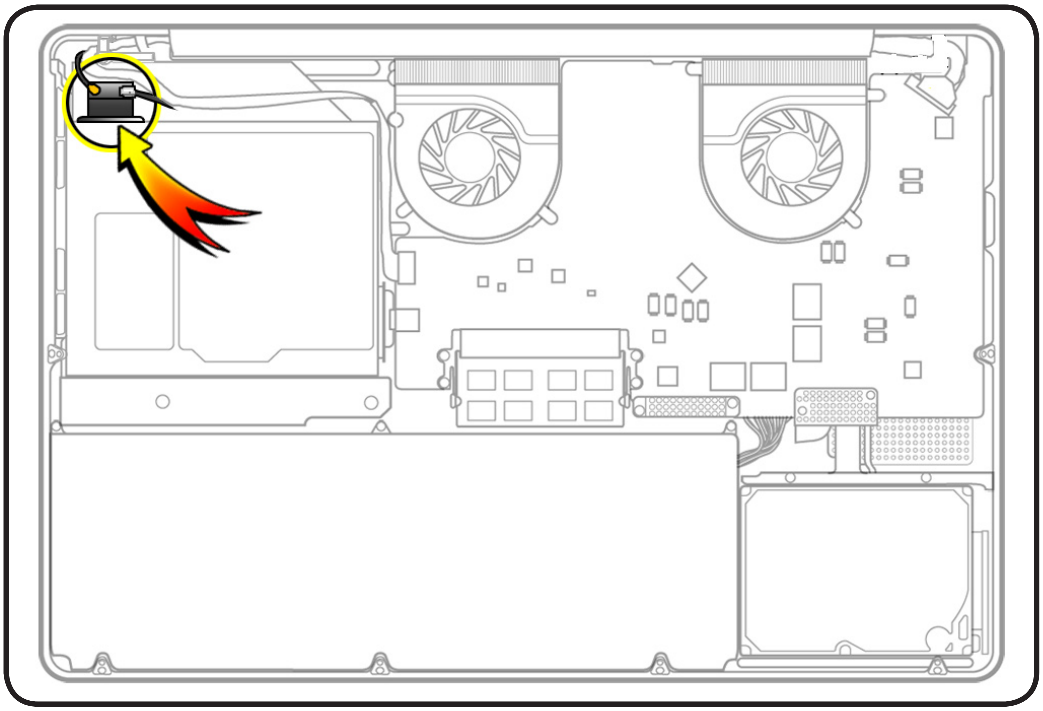


Bluetooth Card and Holder

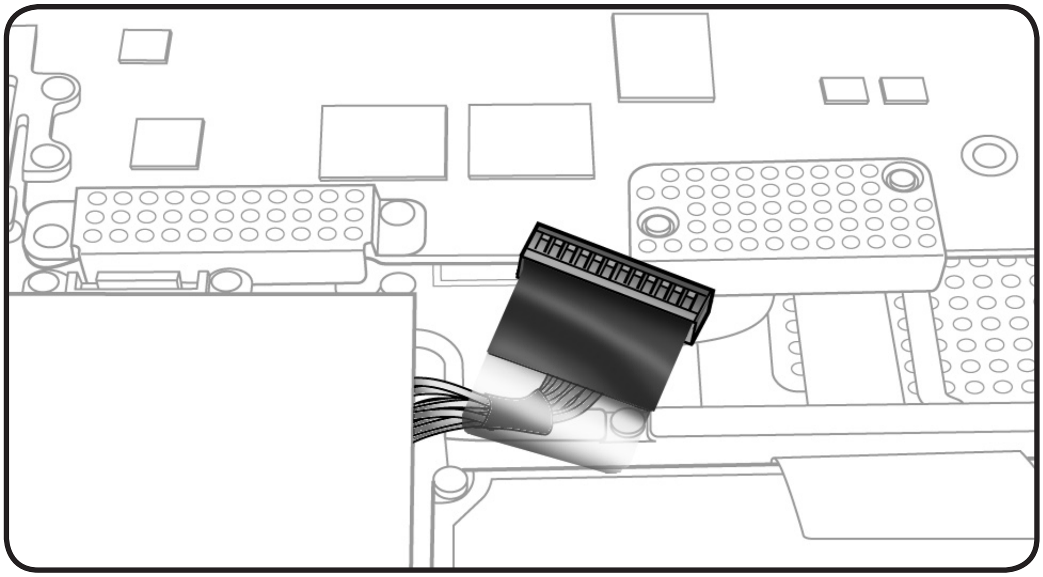
First Steps

Remove:

- Bottom case



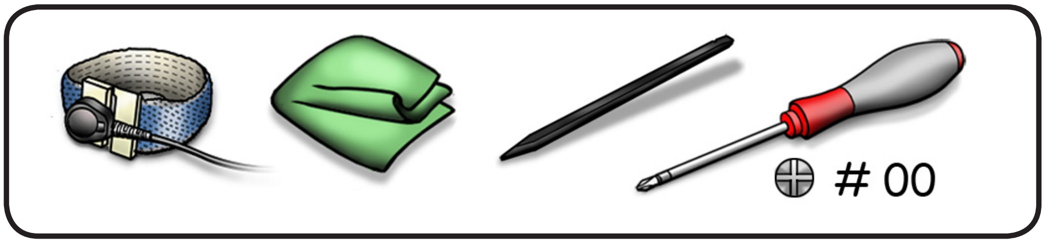
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

Clean, soft, lint-free cloth

- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick

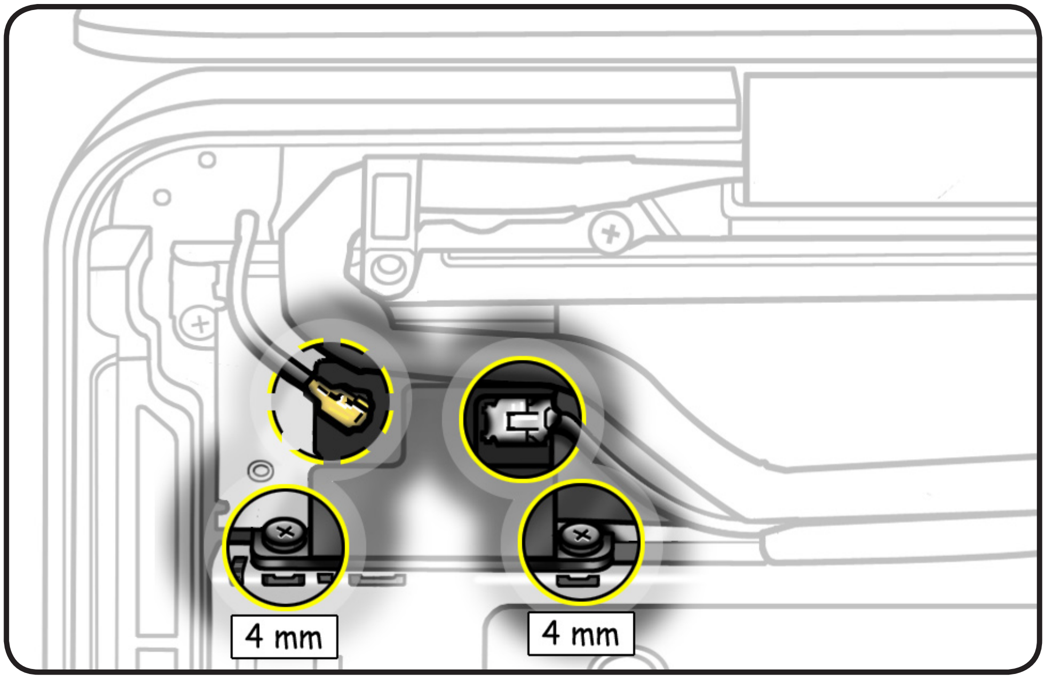


Removal

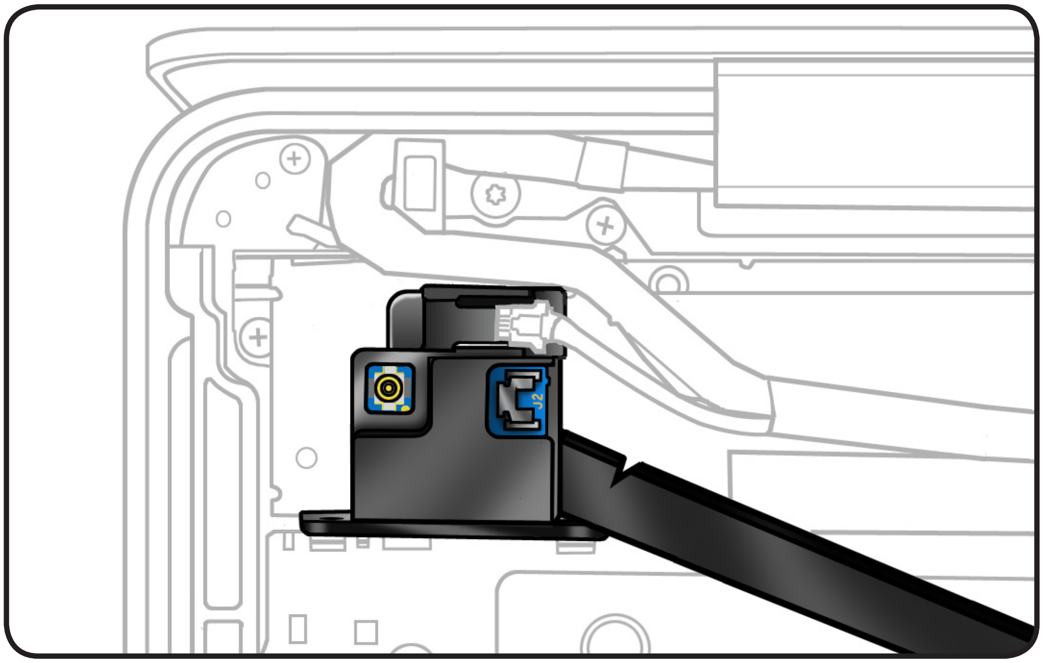
1 Remove 2 (4-mm) 922-8329 screws.

2 Peel up mylar cover, and disconnect 2 cables:

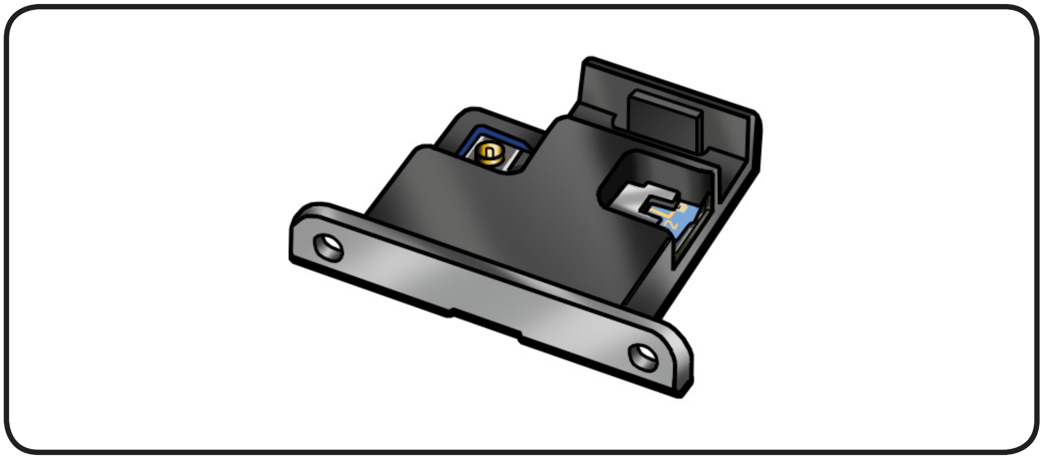
- Bluetooth antenna
- Camera



3 Use black stick to pry out Bluetooth holder.

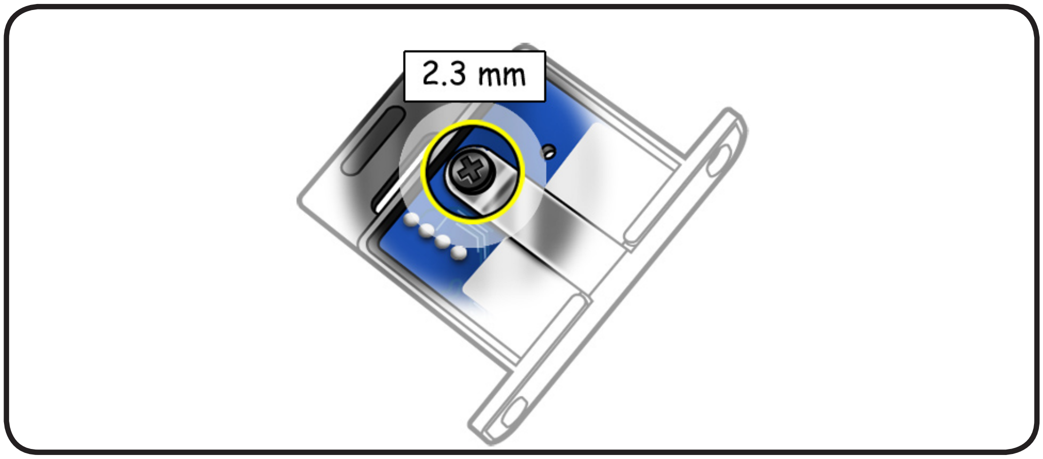


4 Remove Bluetooth card and holder.



5 Turn over holder, and remove 2.3-mm screw (part of 076-1348 kit) from metal bracket.

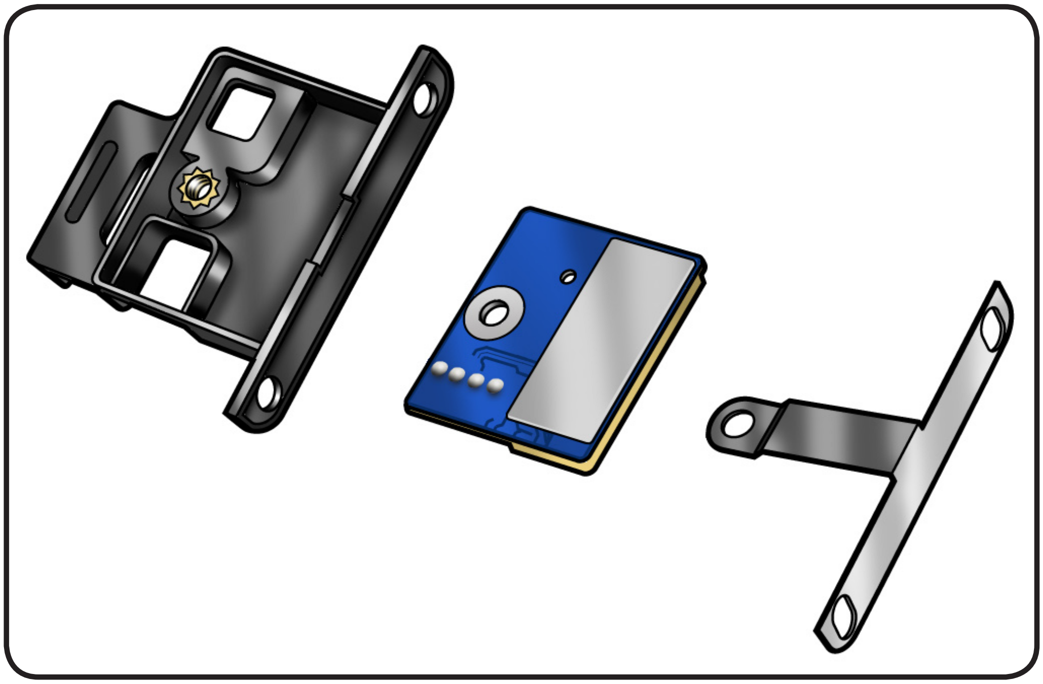
6 Lift out card from holder.



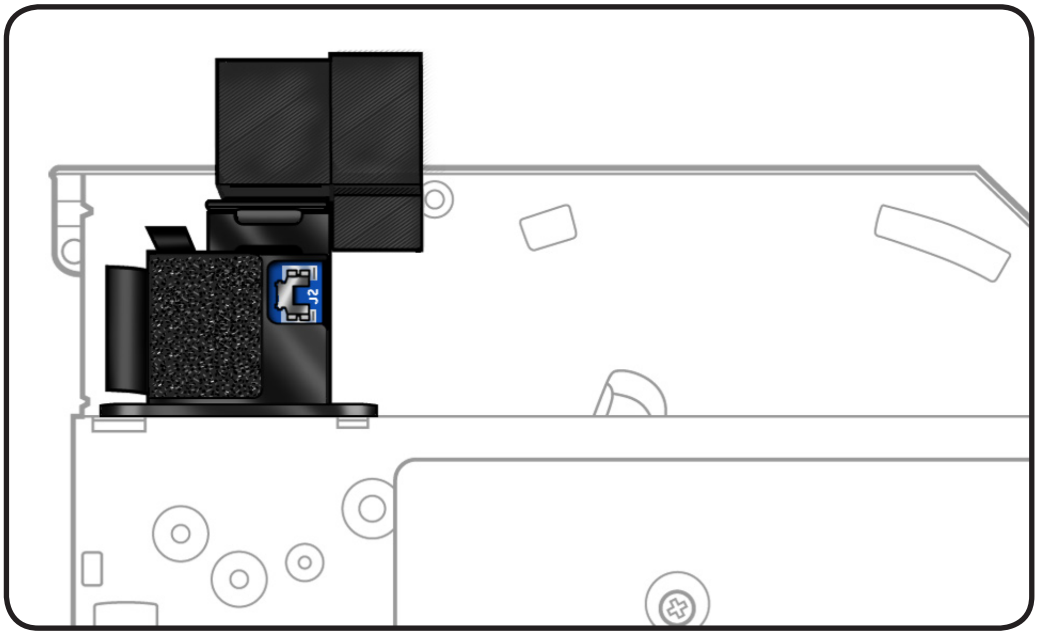
Replacement

1. Remove any adhesive residue left on optical drive from Bluetooth holder.

2. Assemble Bluetooth card and bracket in holder.



3. Install Bluetooth holder on optical drive so that
- screw holes align
- holder aligns with cushion on optical drive

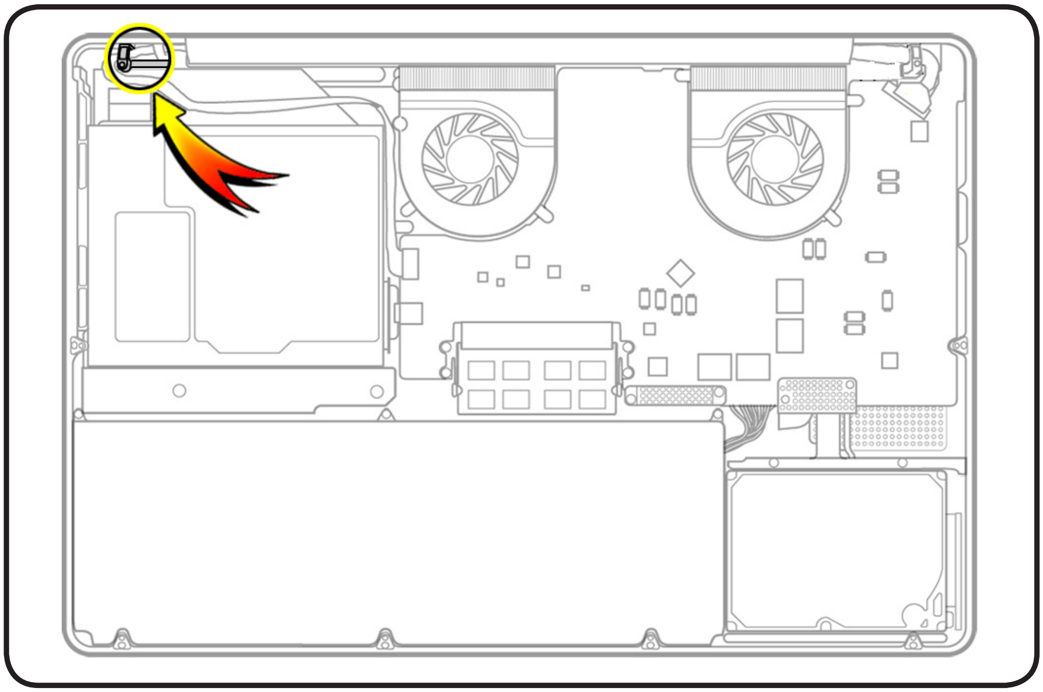


Camera Cable Guide

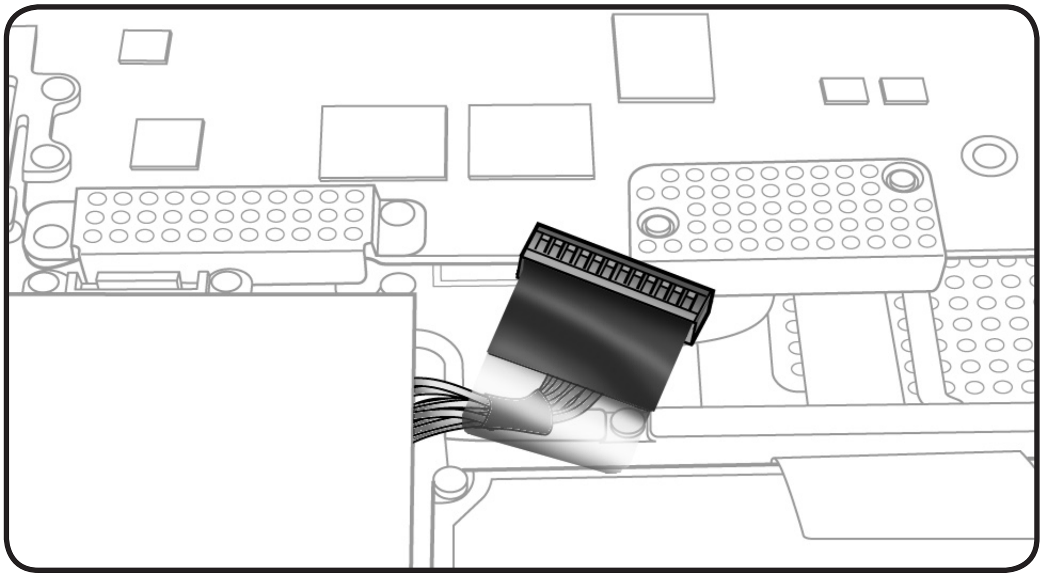
First Steps

Remove:

- **Bottom case**



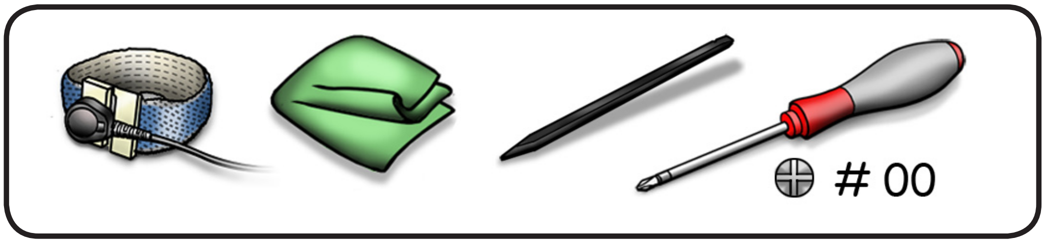
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

Clean, soft, lint-free cloth

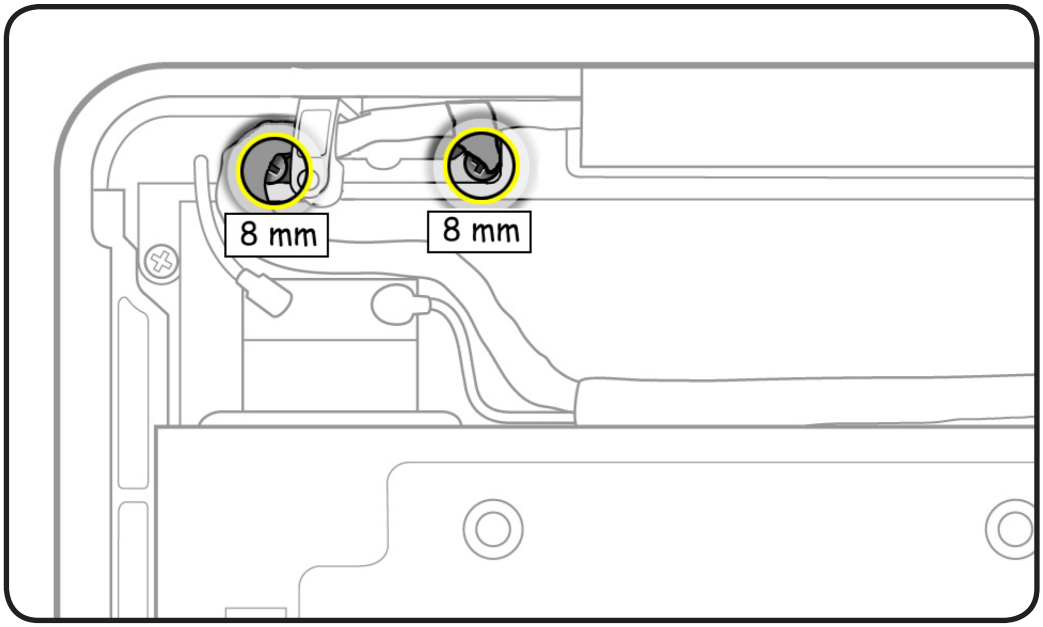
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



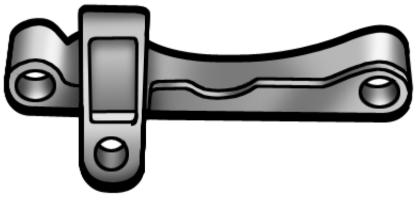
Removal

1 Remove 2 (8-mm) 922-8645 screws.

Replacement Note: Be sure to anchor the ground tab when reinstalling the screw closest to the display clutch cover.



2 Remove the camera cable guide.

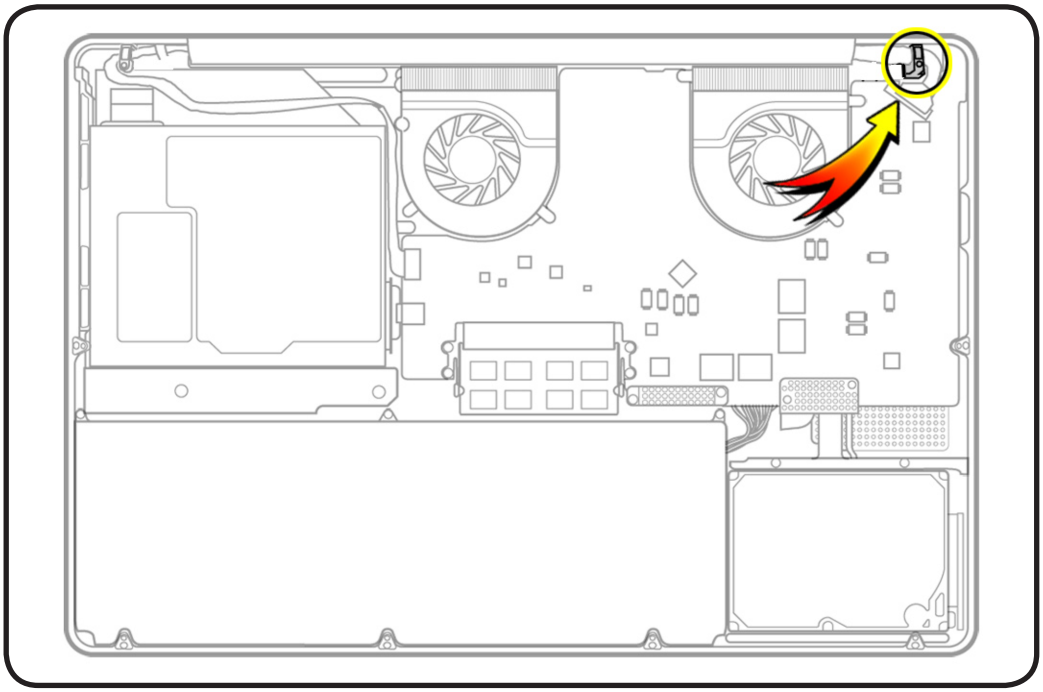


LVDS Cable Guide

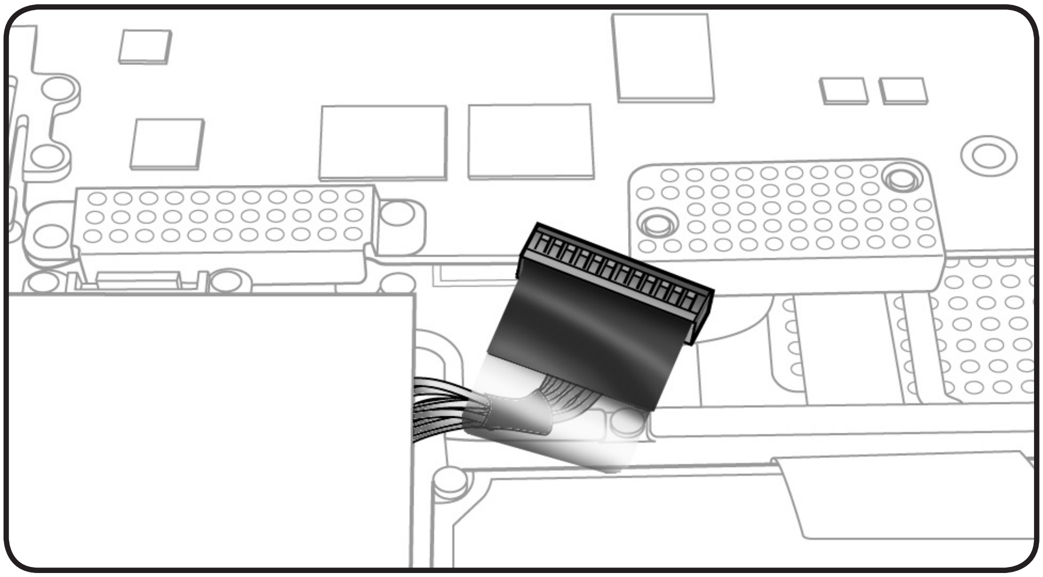
First Steps

Remove:

- **Bottom case**



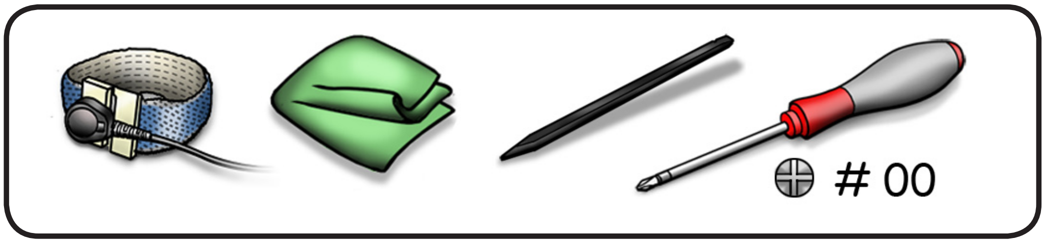
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

Clean, soft, lint-free cloth

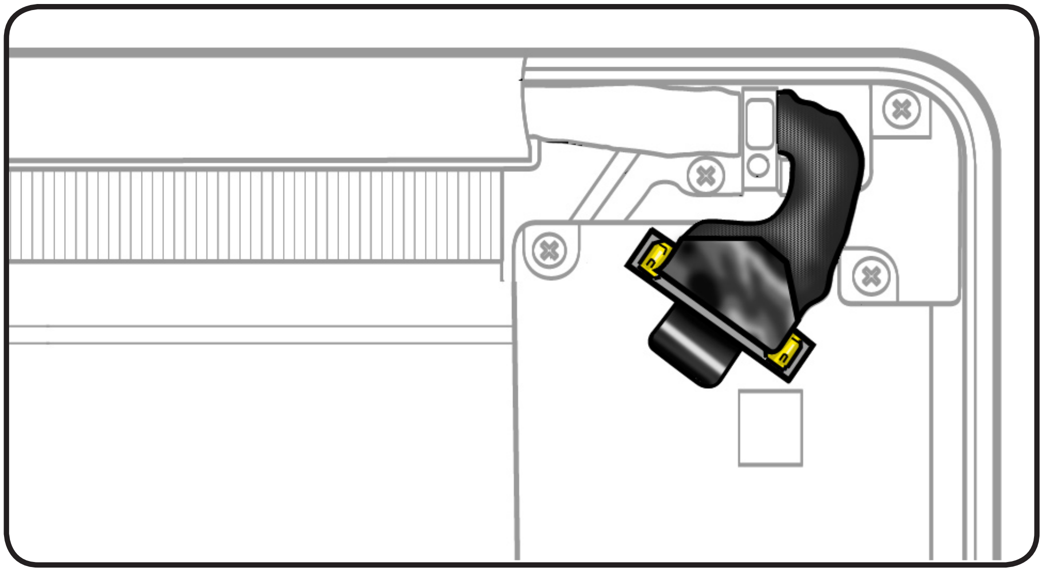
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



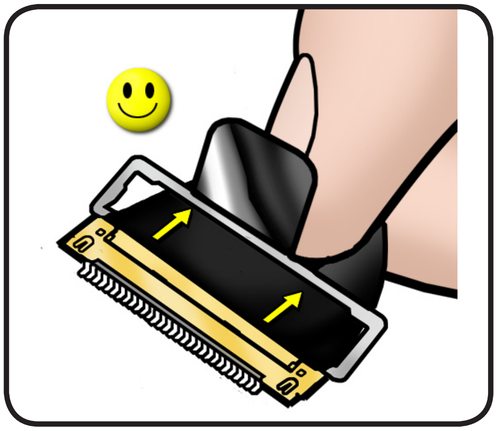
Removal

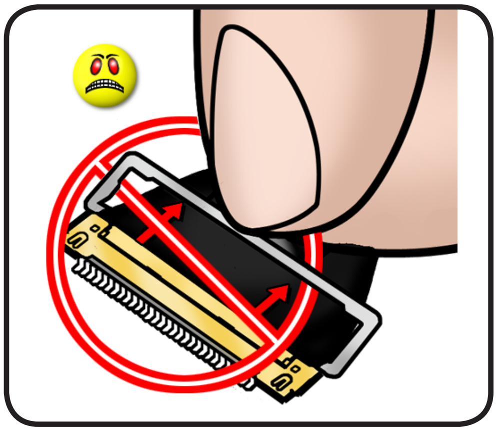
1 Locate LVDS cable.

2 To disconnect LVDS cable, grasp black tab and gently swing LVDS lock bar up and back to unlock the cable.



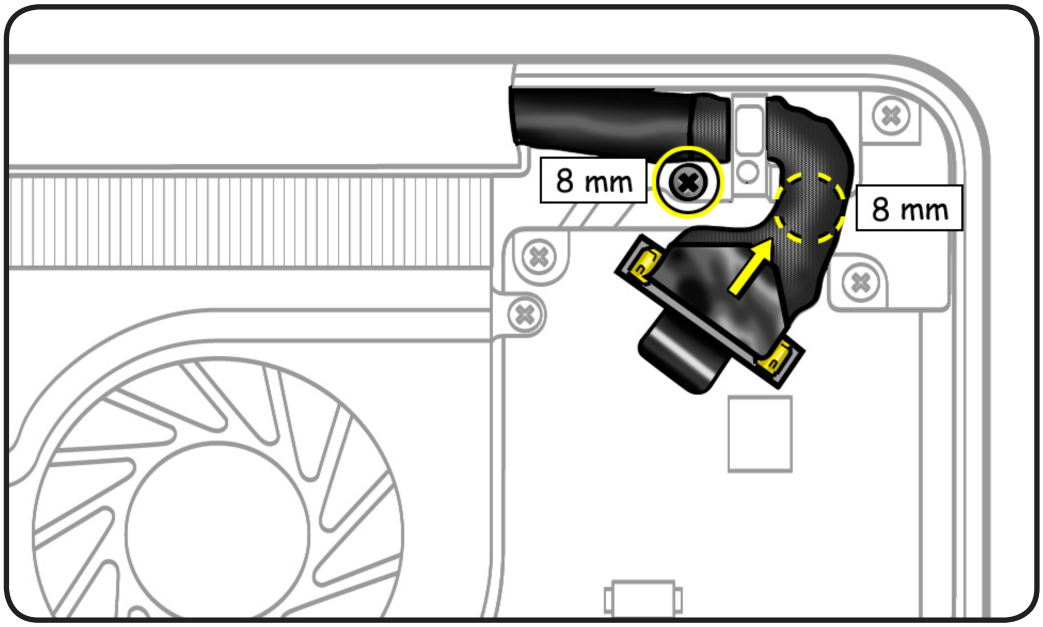
3 Slide cable out of connector by pulling the cable. Do not pull the black tab or lock bar.



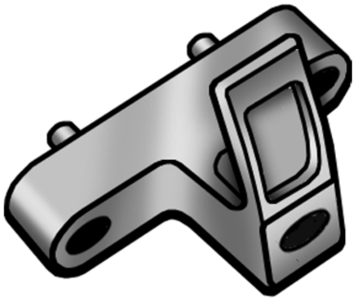


4 Remove 2 (8-mm) 922-8645 screws.

Replacement Note: Be sure to anchor the ground tab when reinstalling the screw closest to the display clutch cover.



5 Remove the LVDS cable guide.

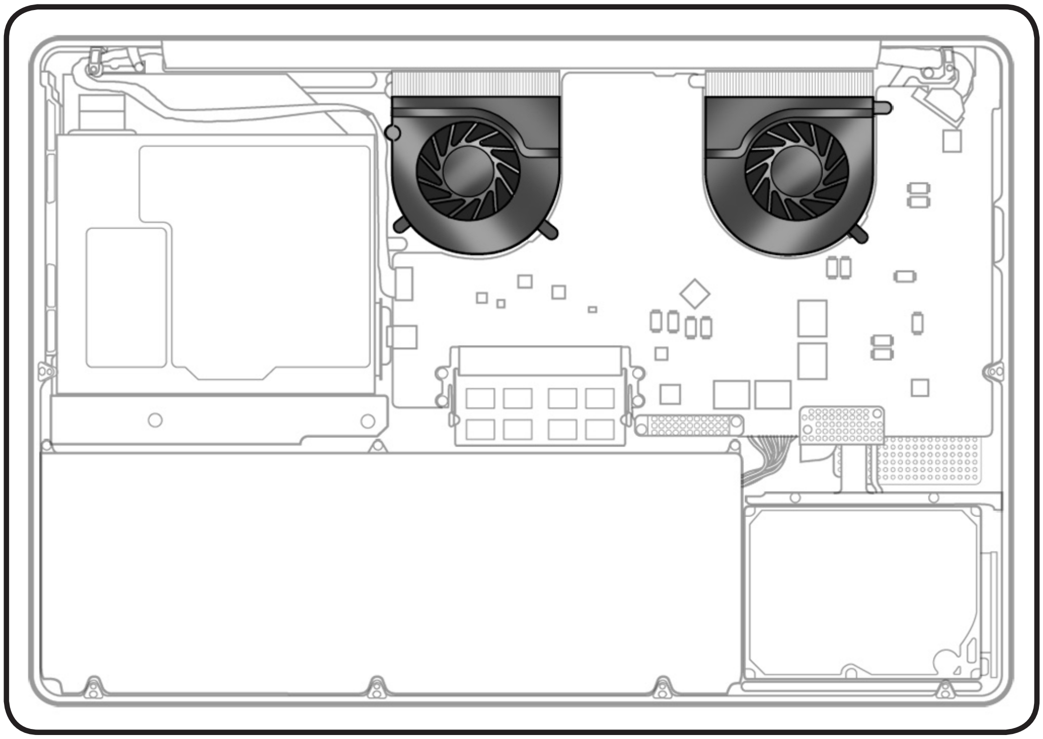


Fans

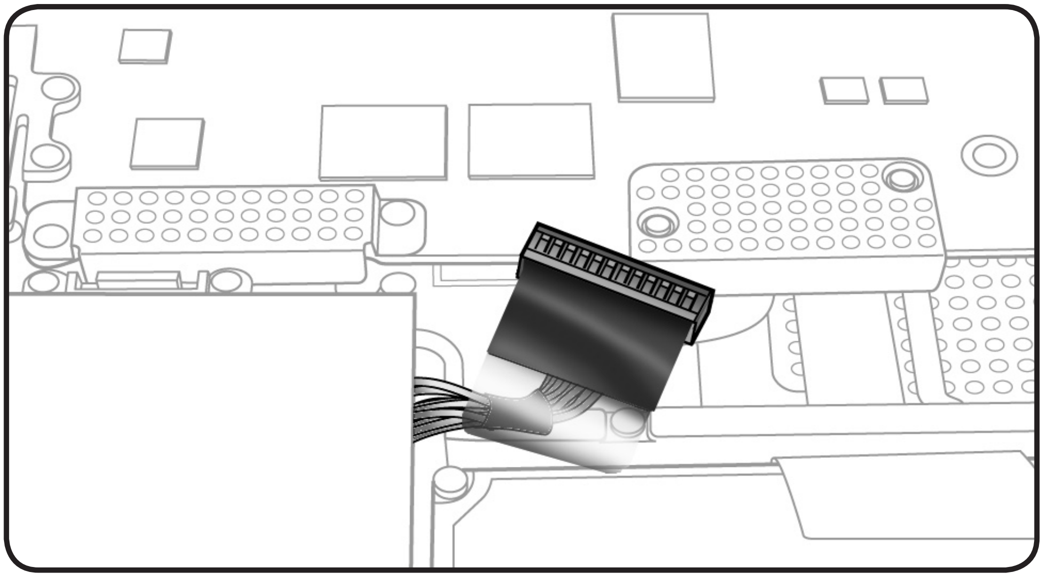
First Steps

Remove:

- Bottom case



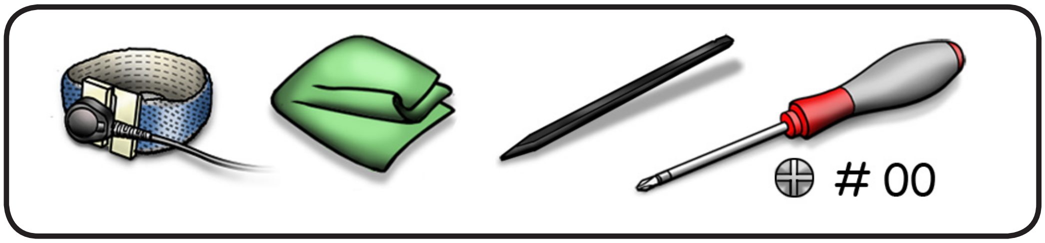
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

Clean, soft, lint-free cloth

- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



Removal

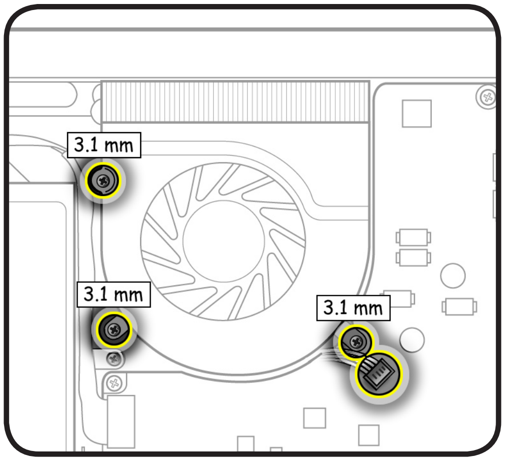
1 Disconnect each fan cable.

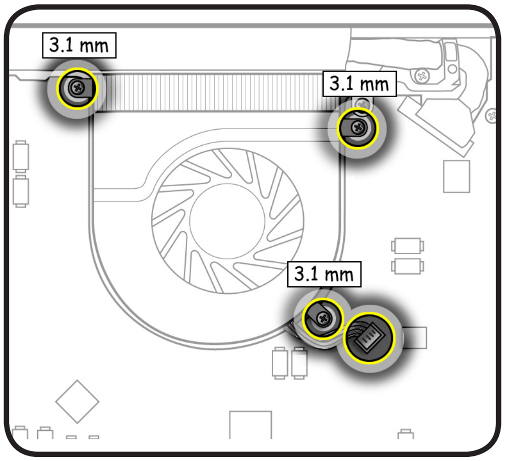
2 Remove 6 (3.1-mm) 922-8754 screws.

3 Remove fan(s) from top case.

Replacement Note: To identify the fans for ordering parts,

- Right Fan is closest to optical drive
- Left Fan is closest to MagSafe power connector





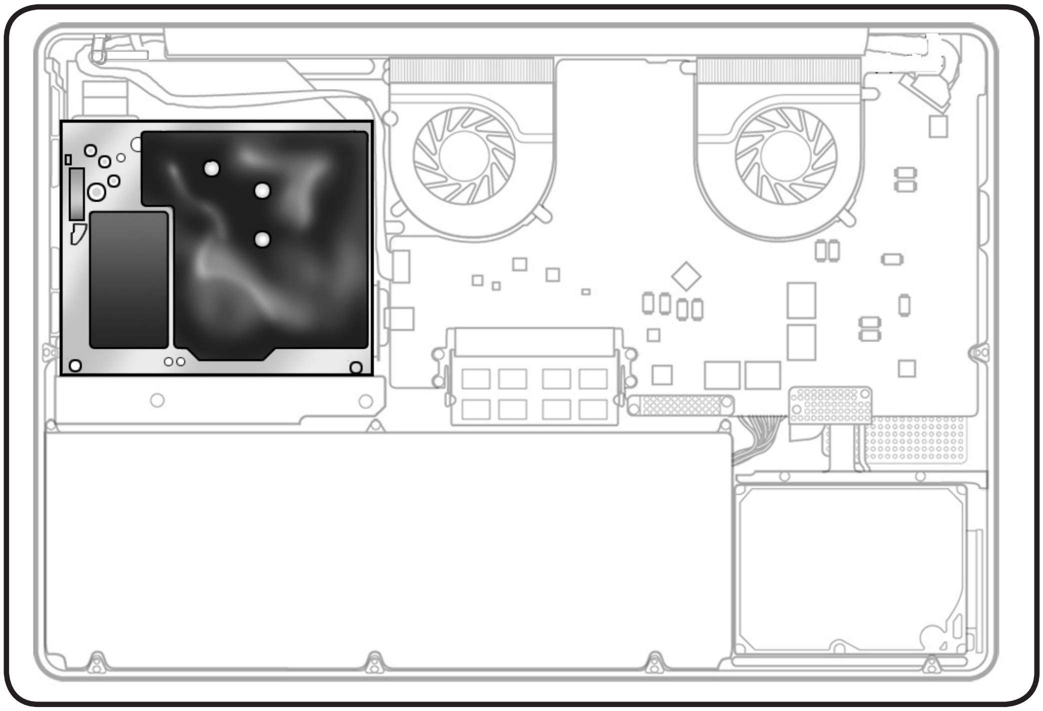
Optical Drive

First Steps

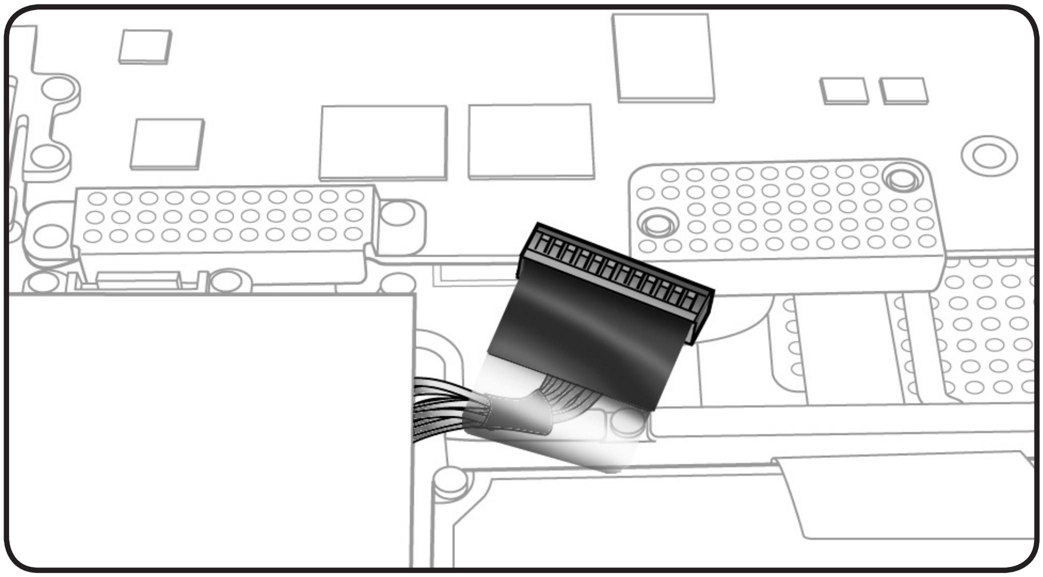
Remove:

- Bottom case

Caution: The optical drive is very fragile. Handle by the sides only.



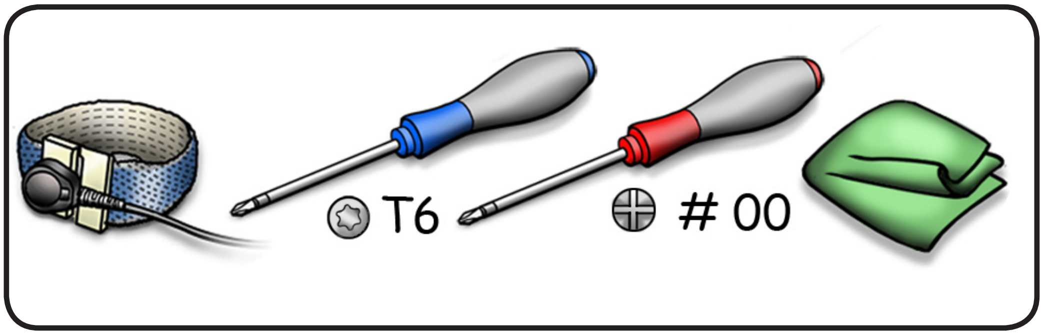
Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

Clean, soft, lint-free cloth

- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Torx T6 screwdriver



Removal

1 With a black stick, carefully pry optical cable straight up and off logic board.

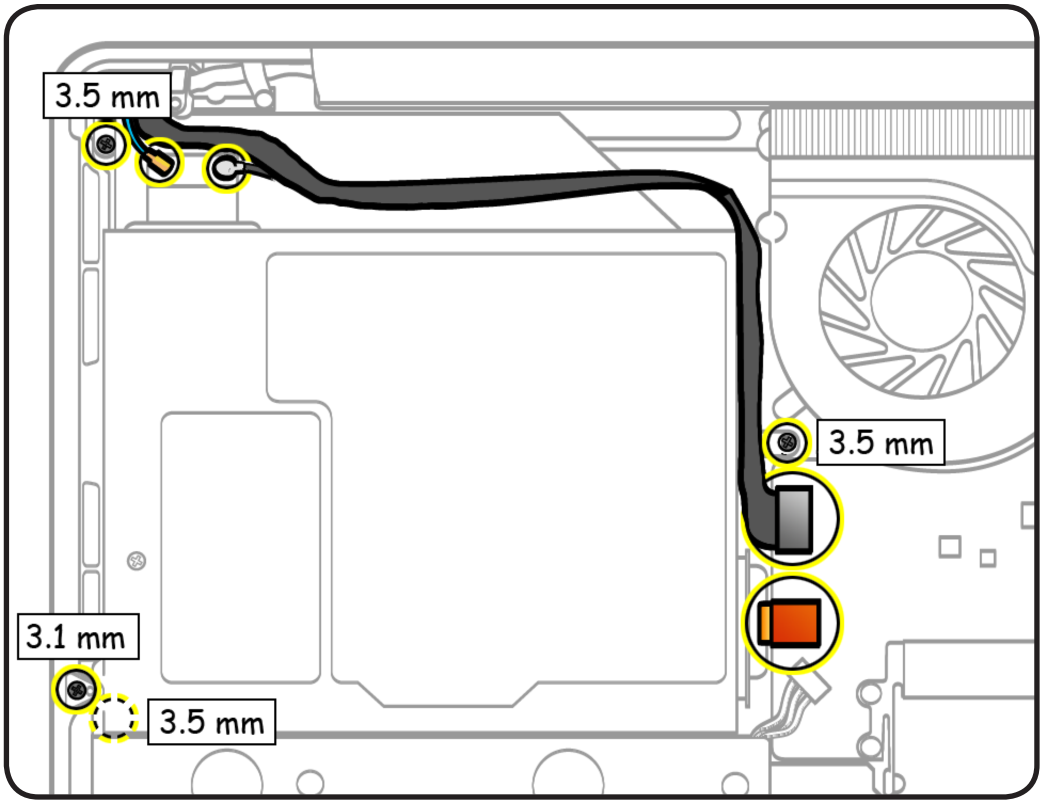
Important Replacement Note: Install flex cable vertically onto logic board connector. If not, logic board pins could bend, causing an undetected disc symptom.

2 Remove 4 screws:

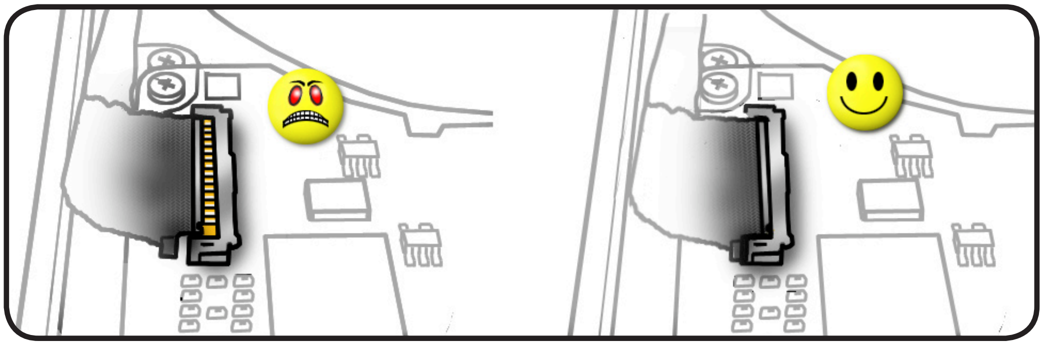
- 1 Torx T6 (3.1-mm) 922-xxxx at top case boss
- 3 Phillips #00 (3.5-mm) 922-8719 at optical drive

3 Disconnect remaining cables:

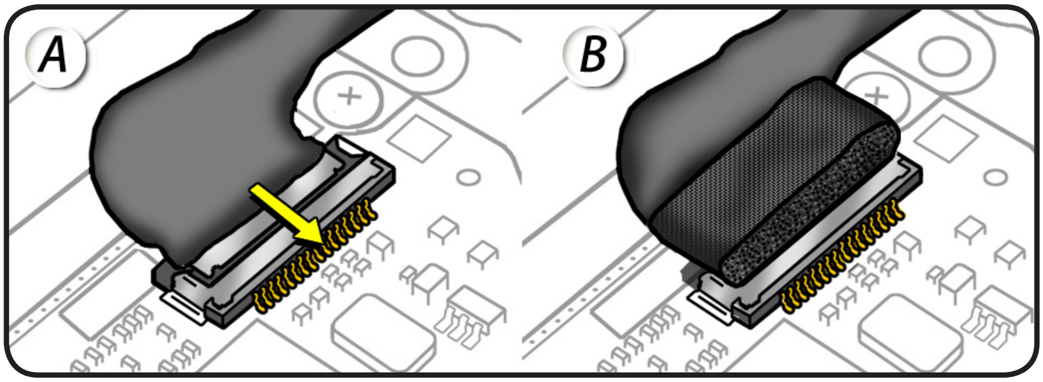
- Bluetooth antenna
- Camera cable (2)



Replacement Caution: When connecting the camera cable, make sure it is fully connected.

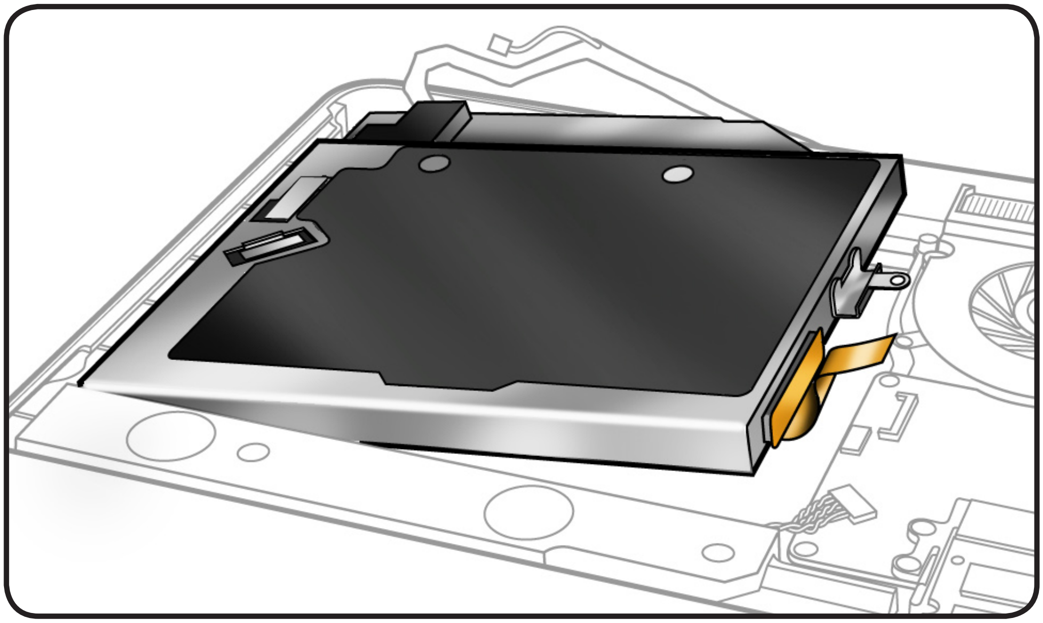


Replacement Caution: To avoid a short to the logic board, be sure to place EMI gasket on camera cable—positioned precisely where shown—**after** cable is fully connected to logic board.

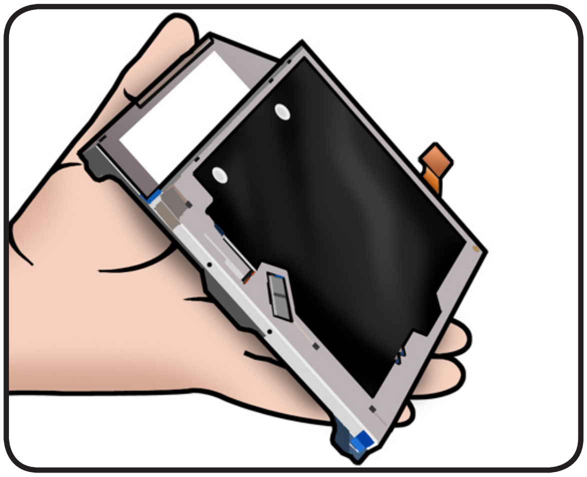


4 Tilt up optical drive.

Replacement Note: If reusing optical drive, do not remove Bluetooth. Otherwise, refer to Bluetooth to transfer it to new optical drive.



5 **Caution**: The optical drive is very fragile. Handle by the sides only!



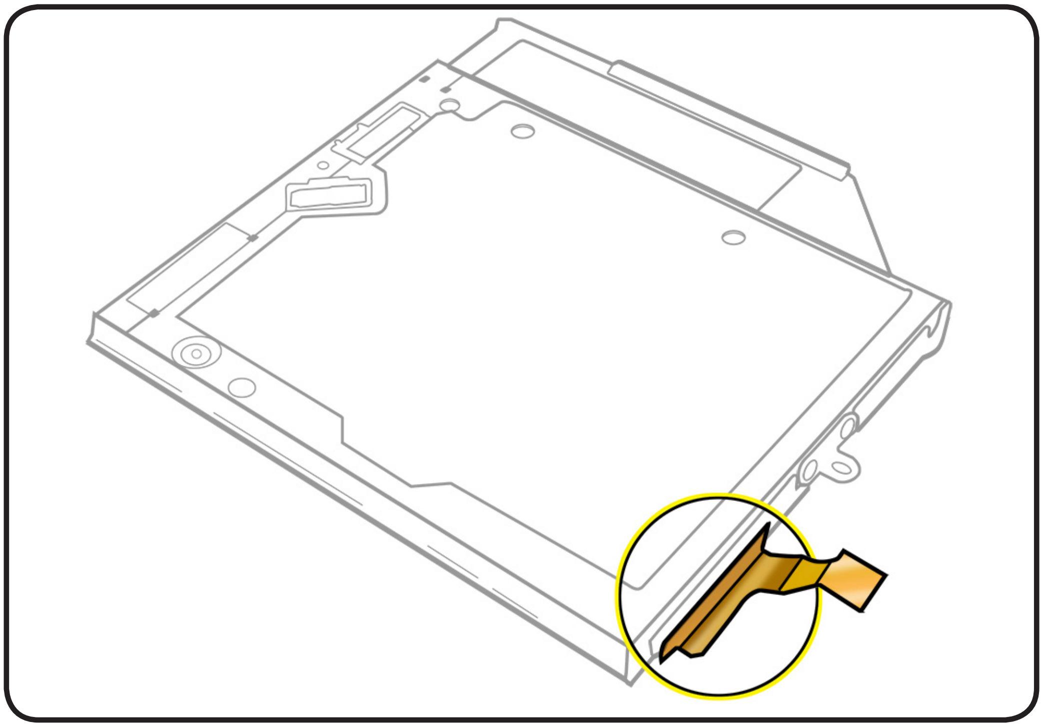
Optical Drive Flex Cable

First Steps

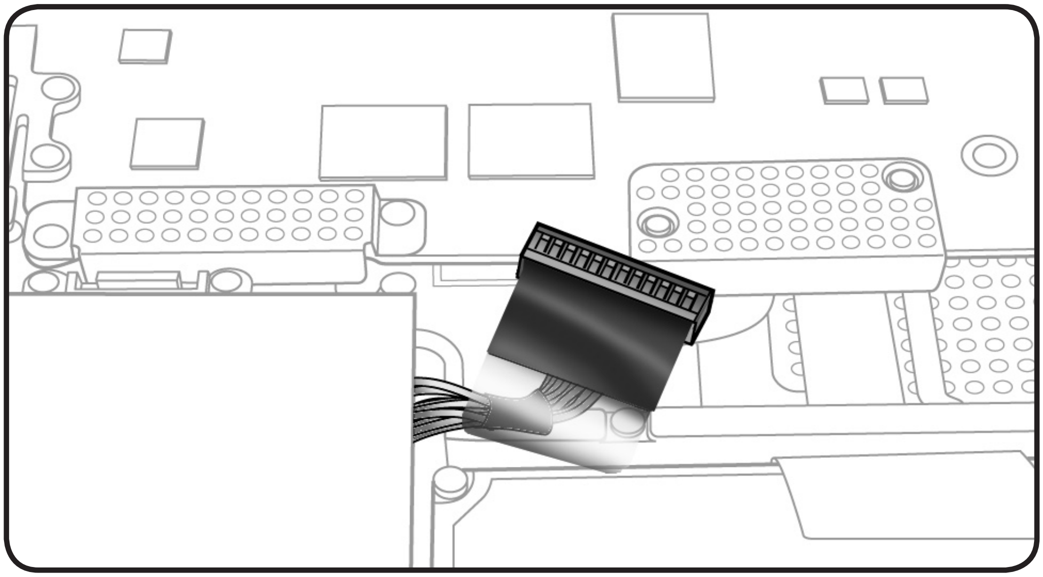
Remove:

- Bottom case
- Optical drive

Caution: The optical drive is very fragile. Handle by the sides only.

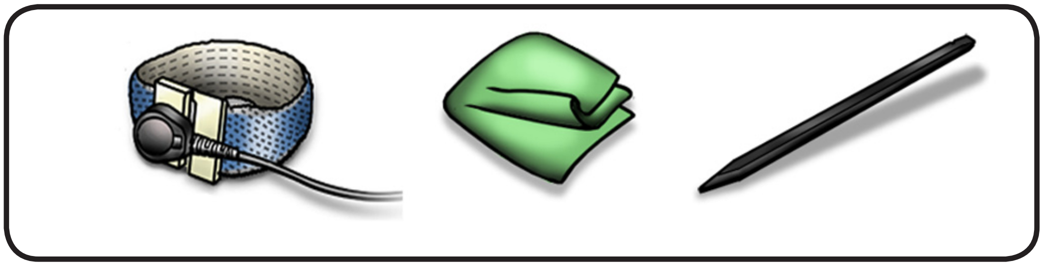


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

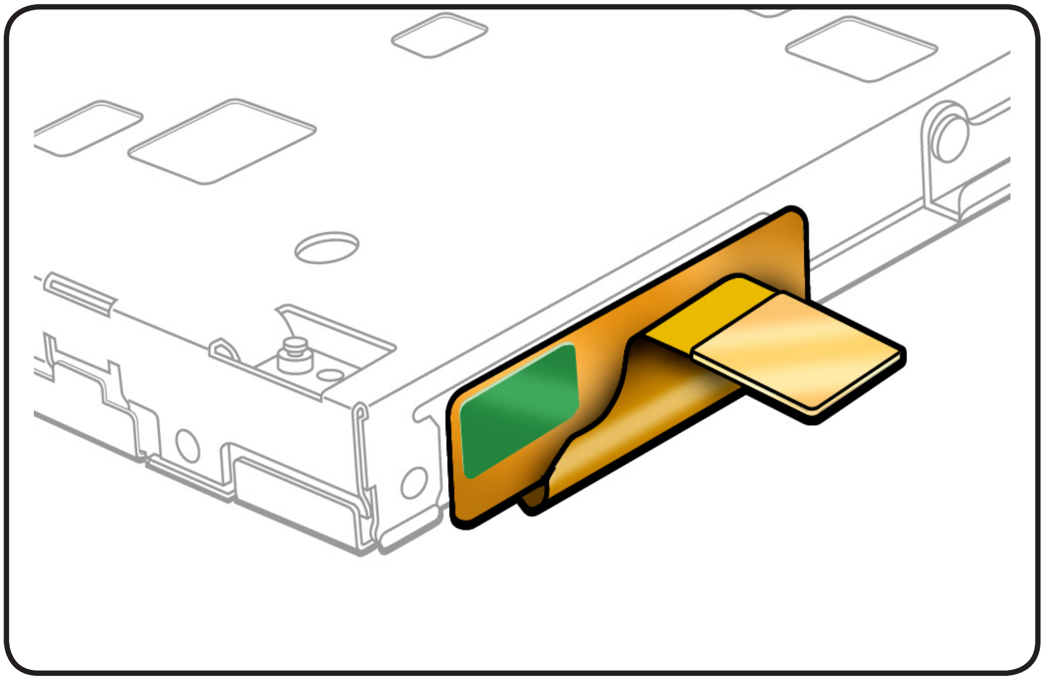
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick



Removal

1 Handle optical drive by sides only.

2 With a black stick or fingernail, carefully wiggle flex cable off optical drive.



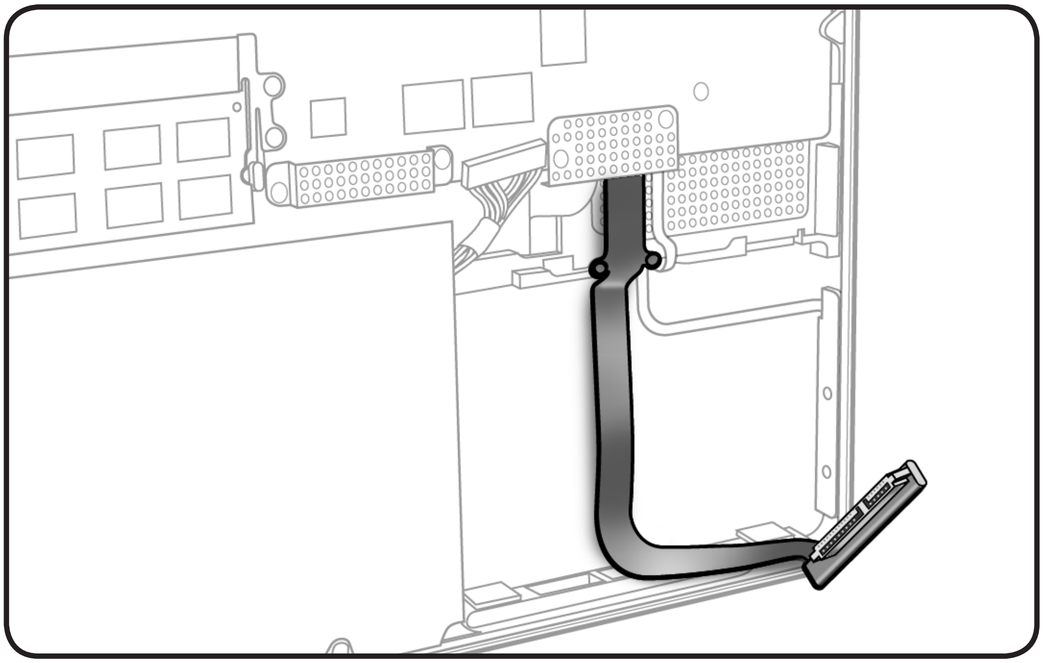
Hard Drive Connector Cable

First Steps

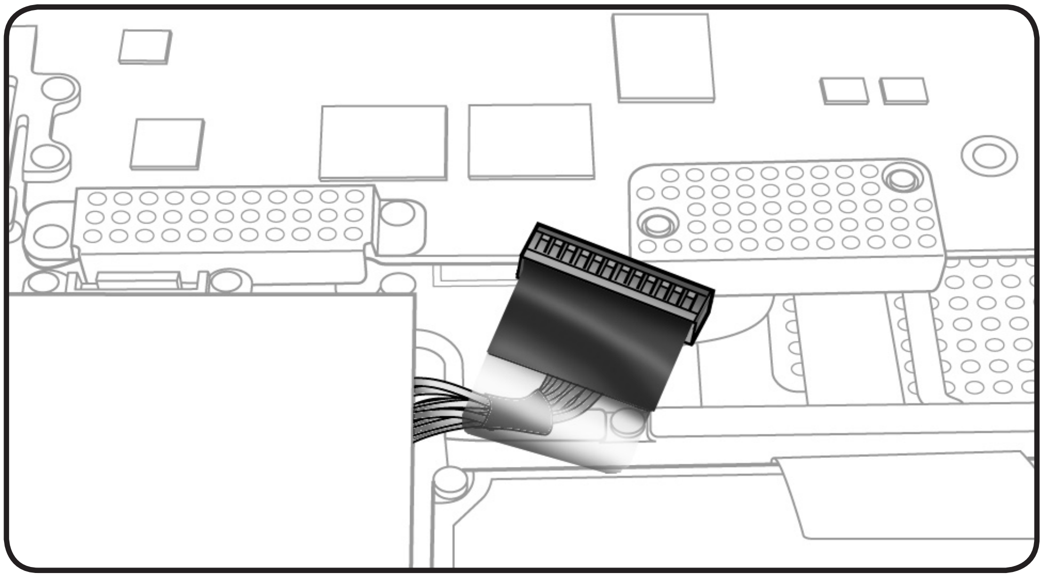
Remove:

- **Bottom case**
- **Hard drive bracket**
- **Hard drive**

Caution: Make sure data is backed up before removing the hard drive.

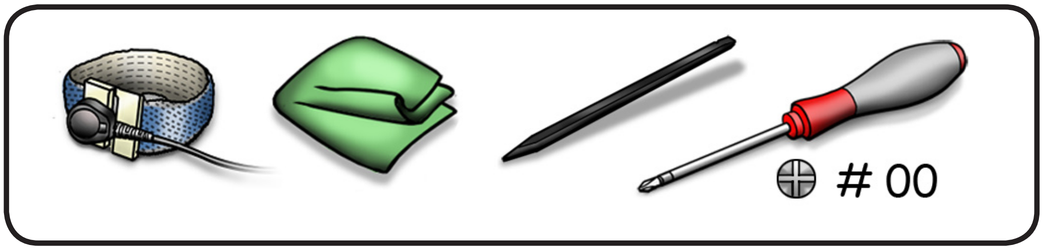


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

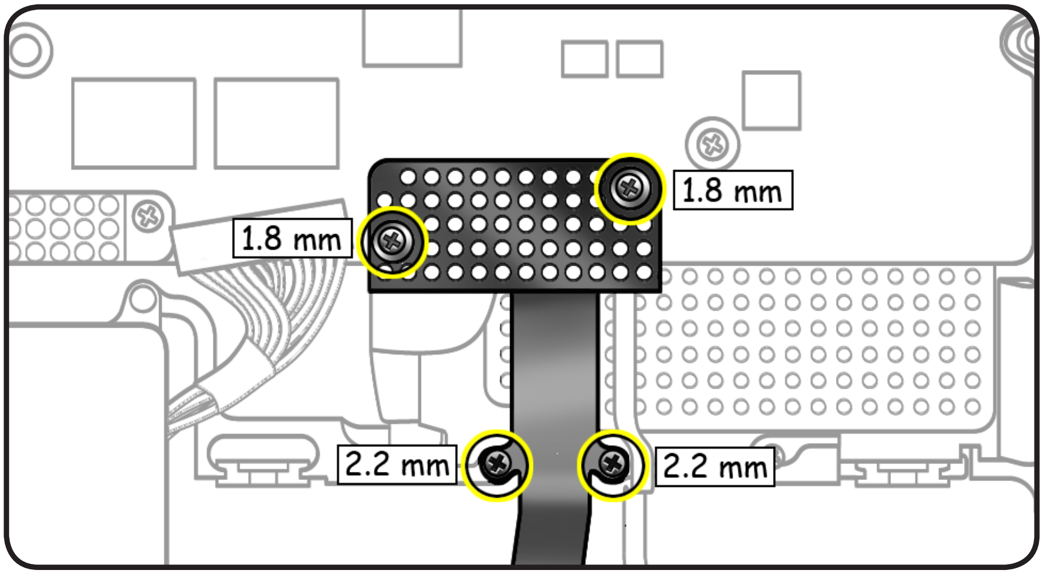
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



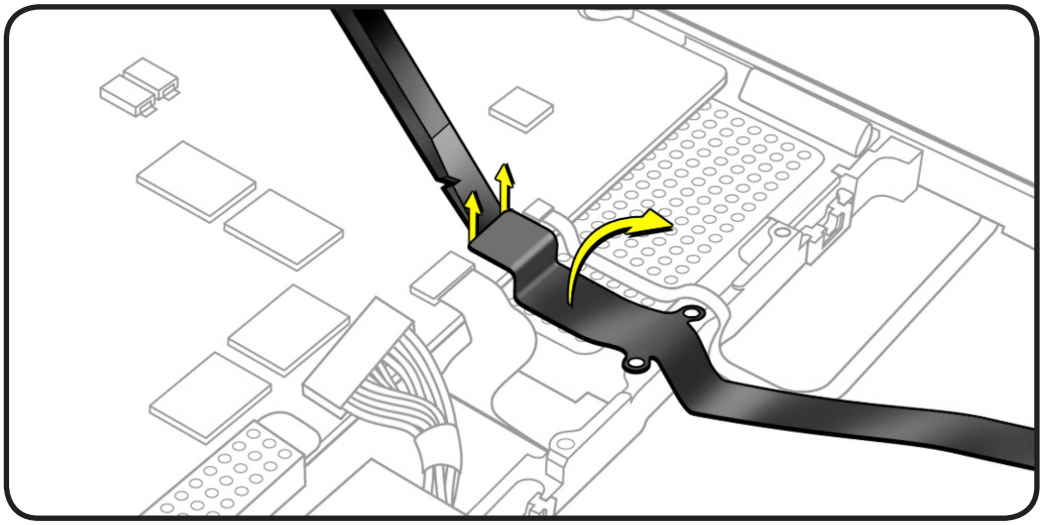
Removal

1 Remove 4 screws:
- 2 (1.8-mm) 922-xxxx at shield
- 2 (2.2-mm) 922-8984 at cable

2 Remove shield.



3 Use black stick to disconnect cable and carefully pry cable up from adhesive.

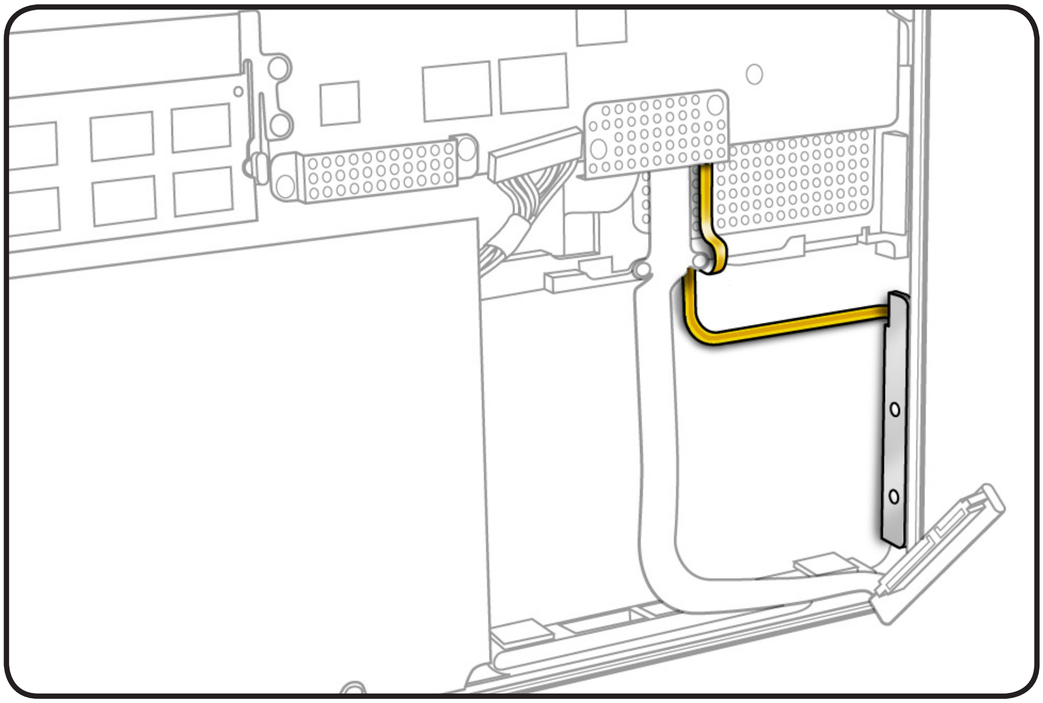


Battery Indicator Light (BIL) Cable and Board

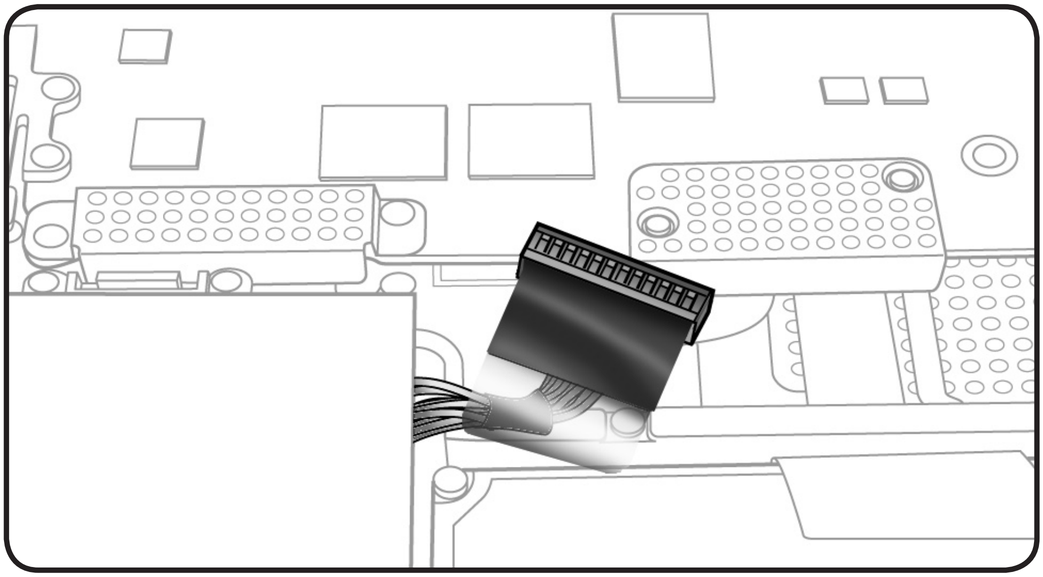
First Steps

Remove:

- Bottom case
- Hard drive bracket
- Hard drive



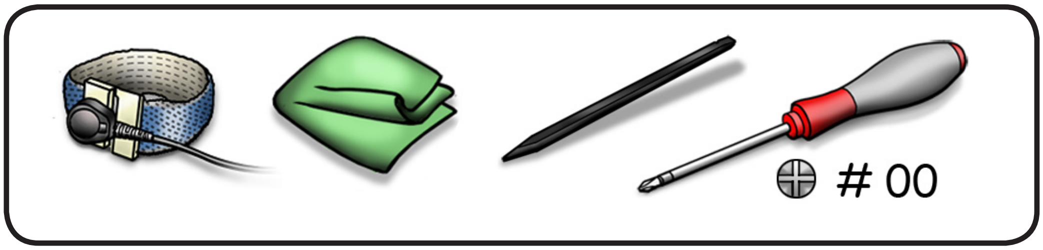
Caution: Make sure data is backed up before removing the hard drive.



Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

Tools

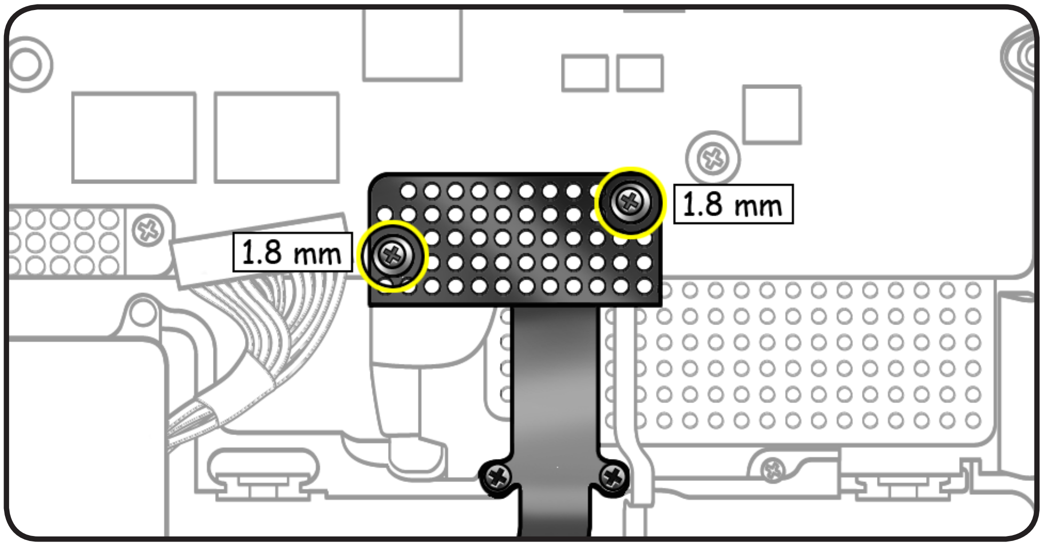
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



Removal

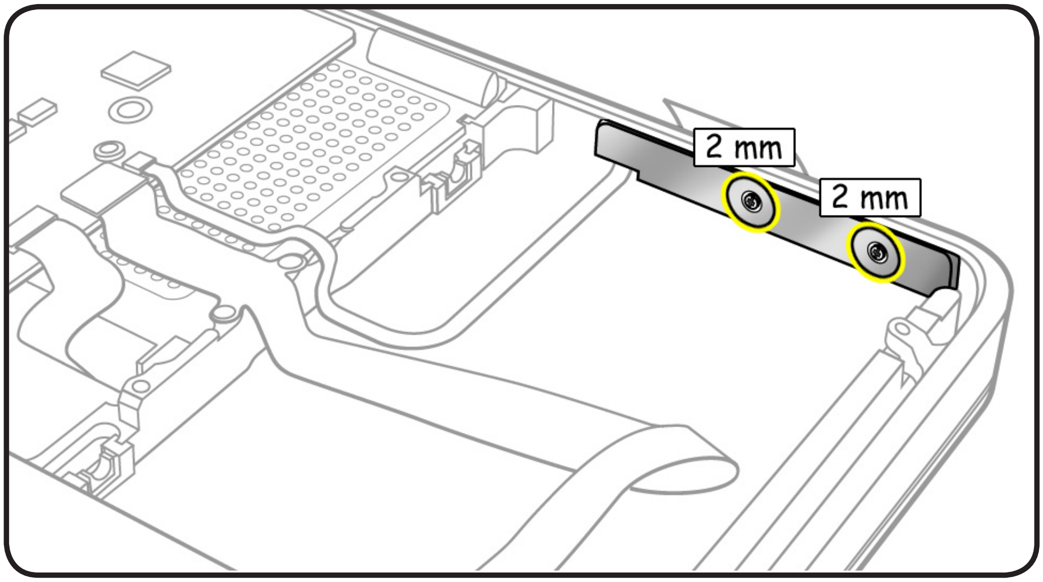
1 Remove 2 (1.8-mm) 922-xxxx screws from the shield.

2 Remove shield.



3 Place tape over BIL button on outside of top case.

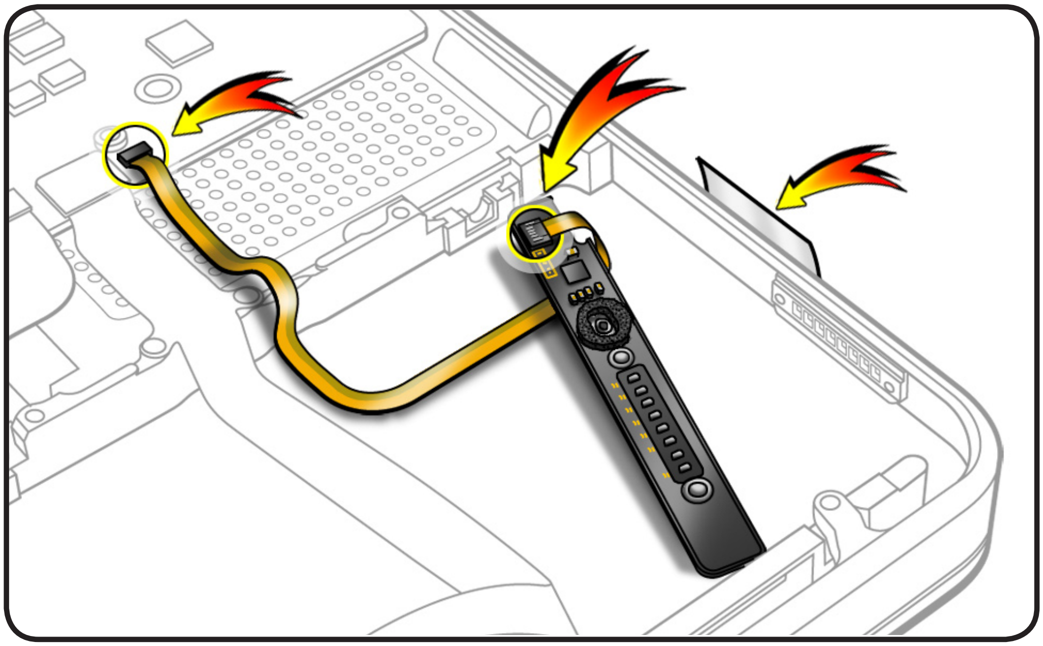
4 Remove 2 (2-mm) 922-xxxx screws from BIL board.



5 Flip over board.

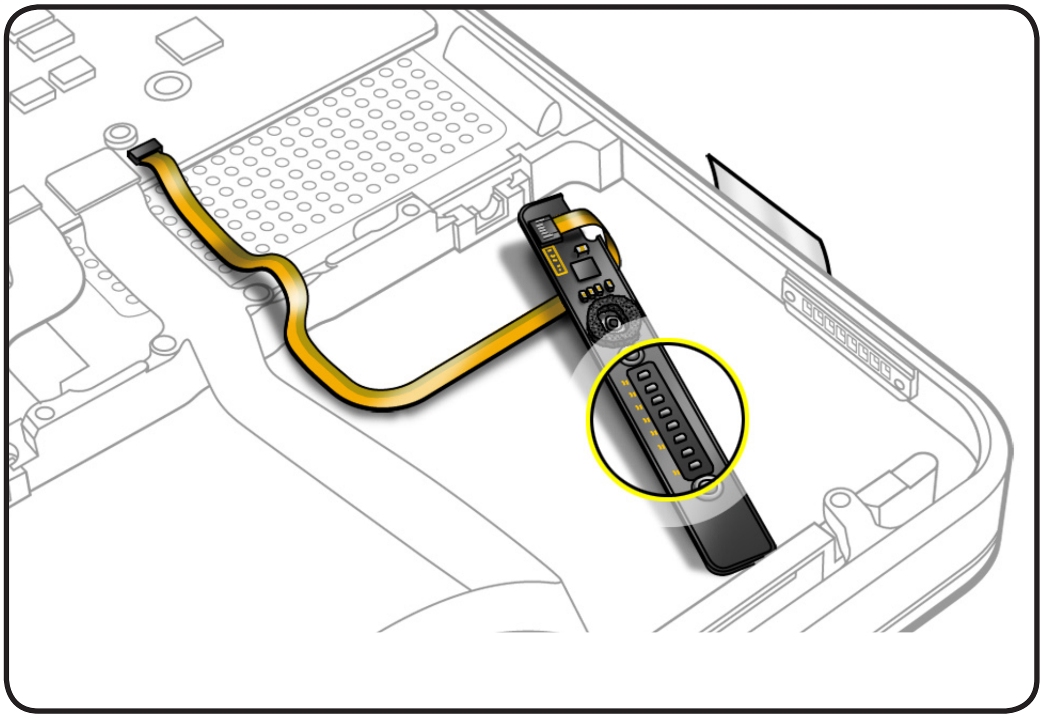
6 Lift lever to disconnect cable from BIL board and from logic board.

Note: The tape will prevent the BIL button from falling out of top case.



Replacement Note: Before replacing the BIL board, check that:

- the long rubber gasket is assembled on top of the LED row
- the BIL button is installed in the top case



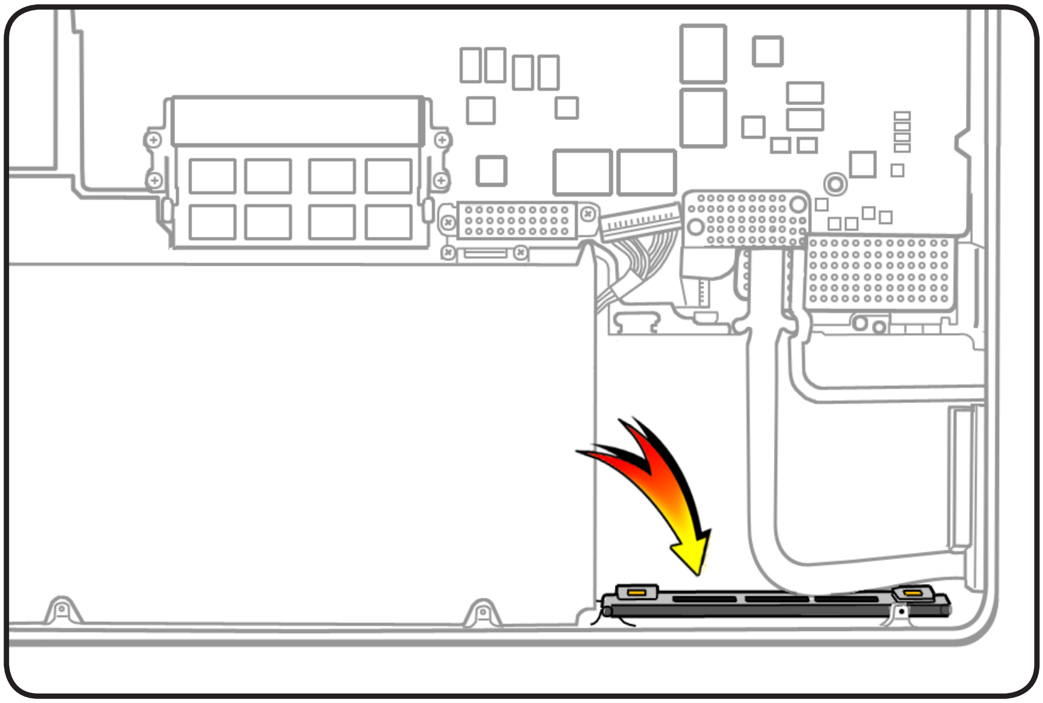
Hard Drive Bracket, Front

First Steps

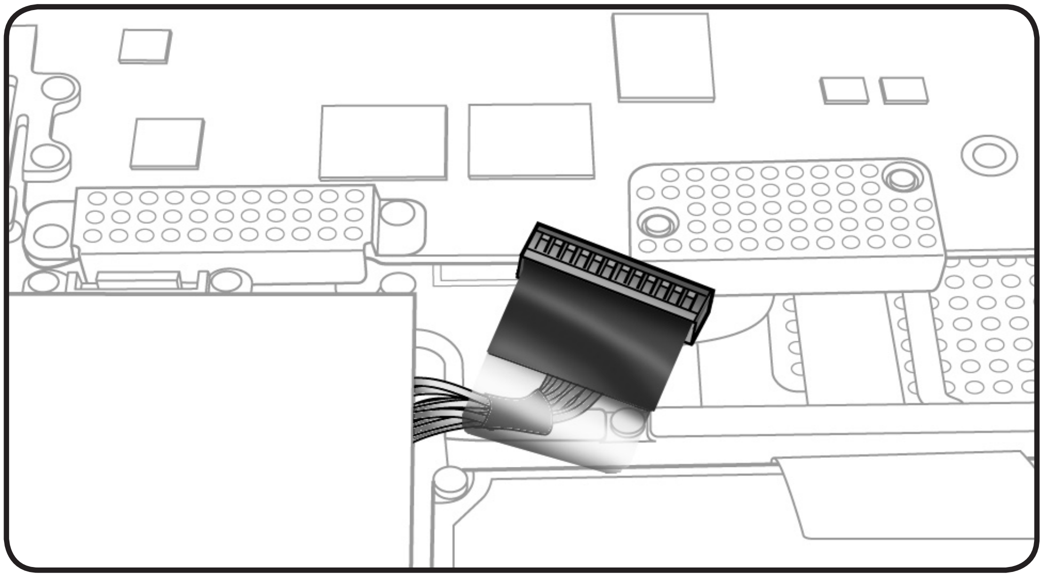
Remove:

- **Bottom case**
- **Hard drive bracket**
- **Hard drive**

Caution: Make sure data is backed up before removing the hard drive.

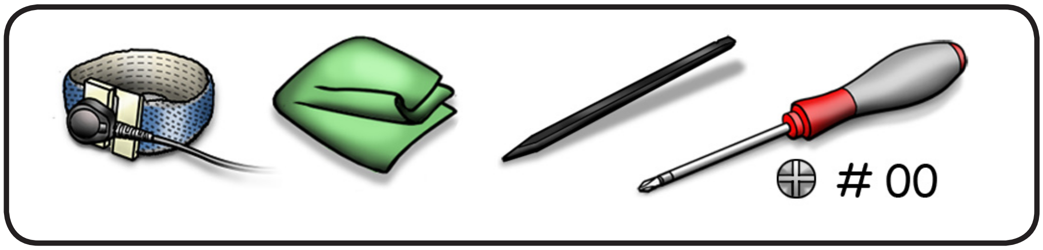


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



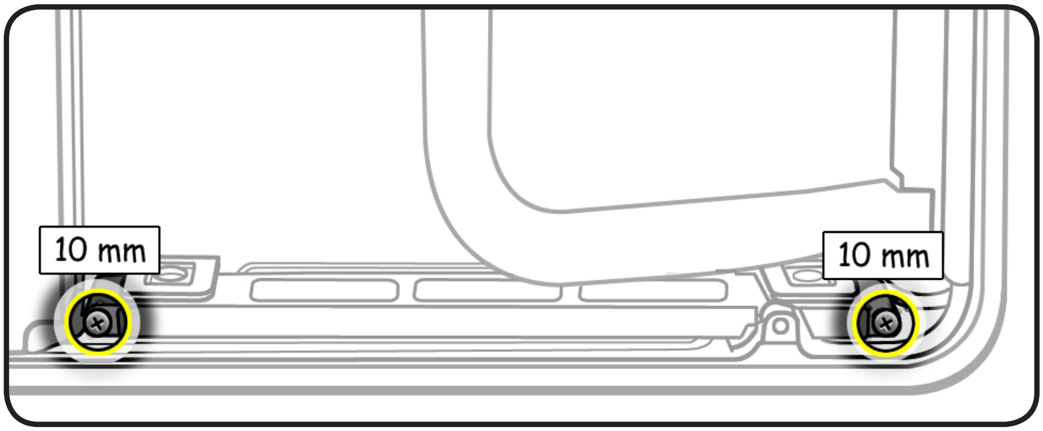
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



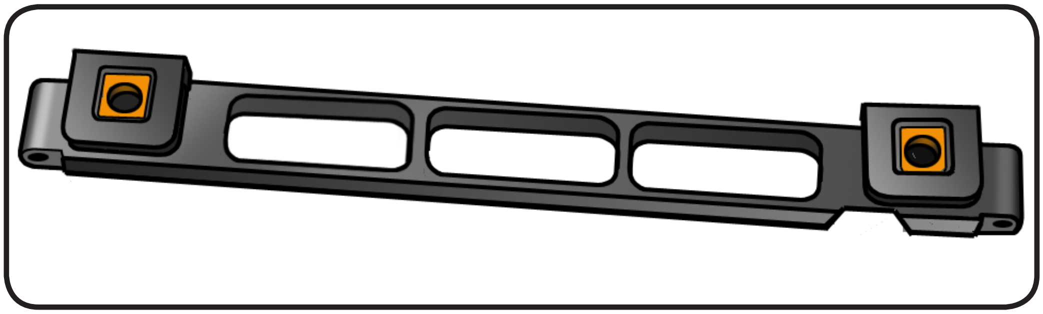
Removal

1 Remove 2 (10-mm) 922-8648 screws.



2 Tilt out bracket.

Replacement Note: Make sure 2 rubber gaskets are installed before installing screws.

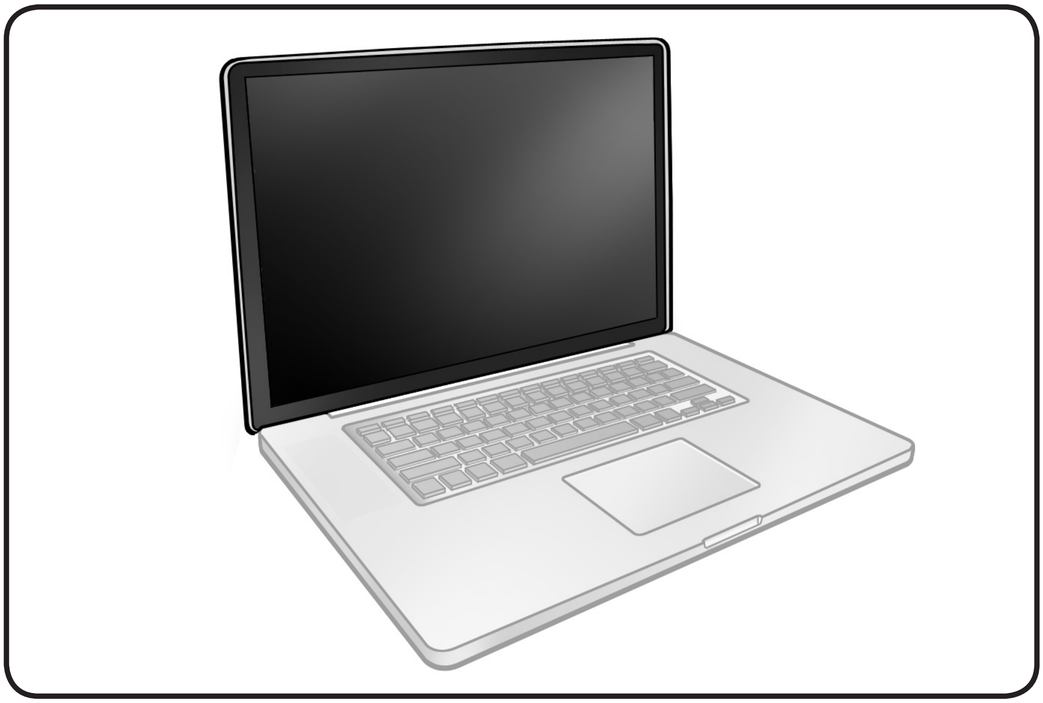


Display Assembly

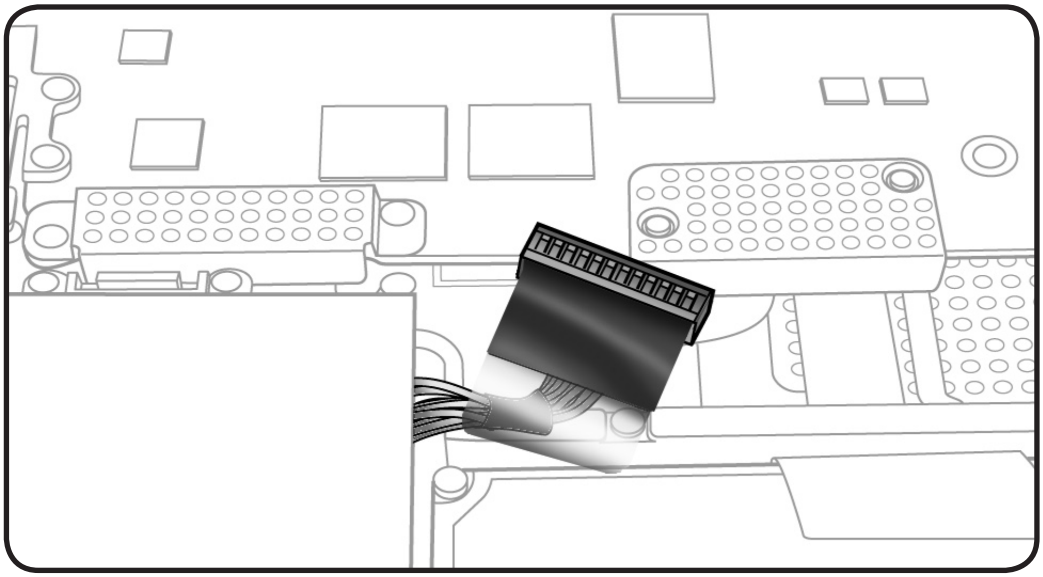
First Steps

Remove:

- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**

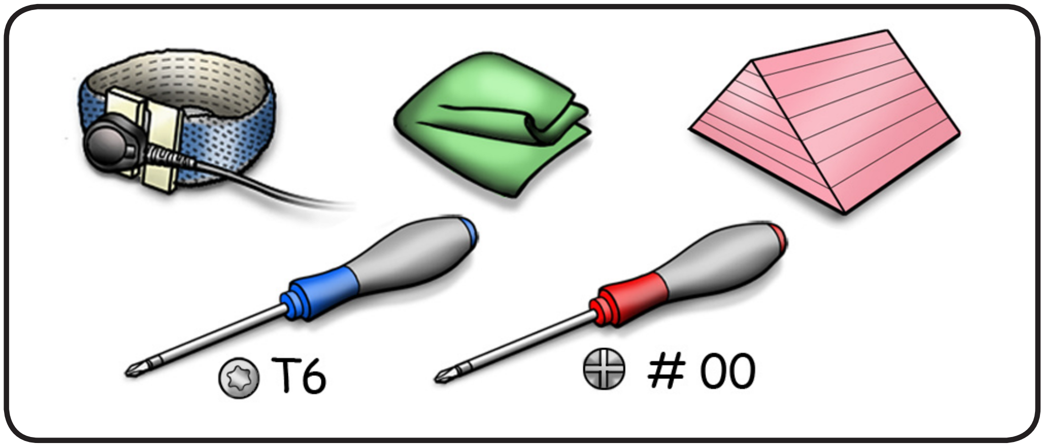


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



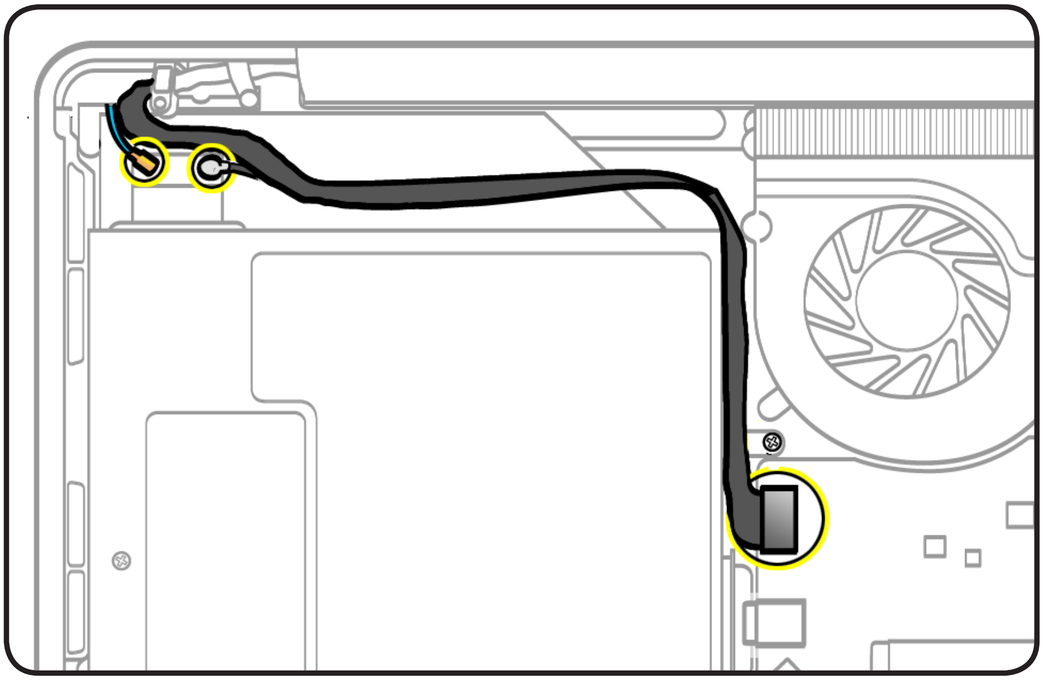
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Torx T6 screwdriver
- Foam wedge fixture



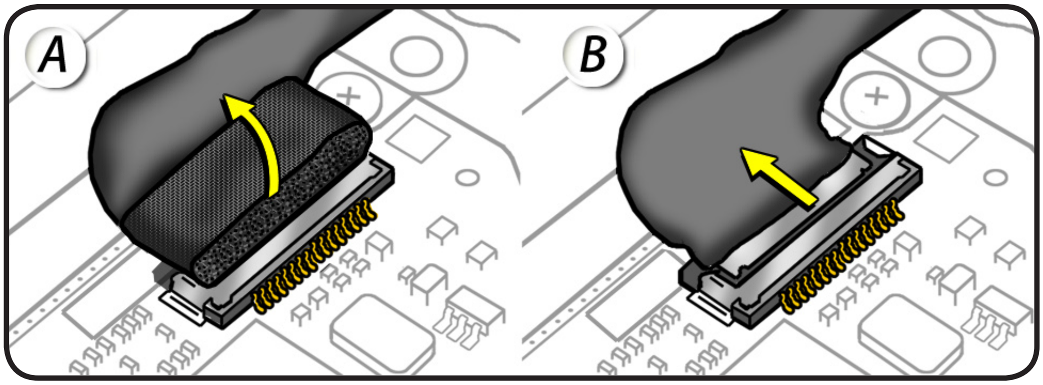
Removal

1 Locate camera cable and Bluetooth connectors.

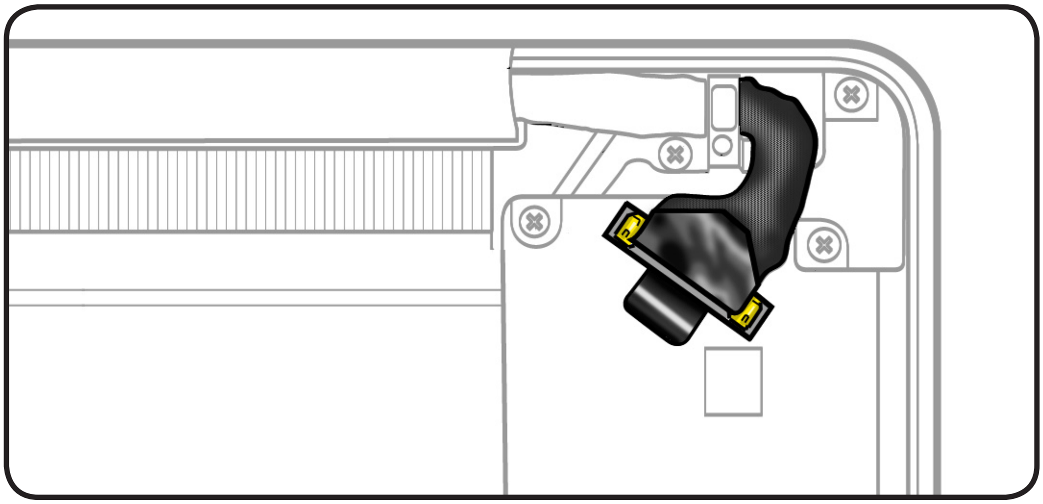


2 Peel EMI gasket off camera cable connector (A).

3 Disconnect camera cable from logic board (B). Pull cable on same horizontal plane as the logic board.

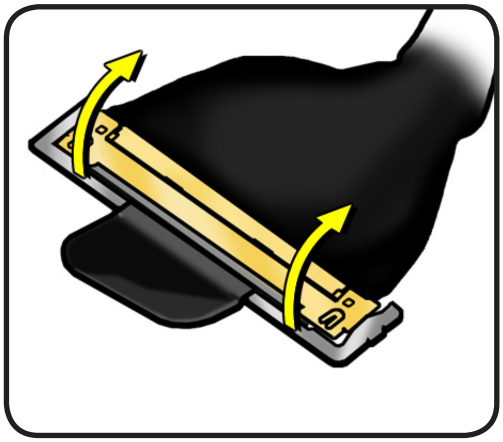


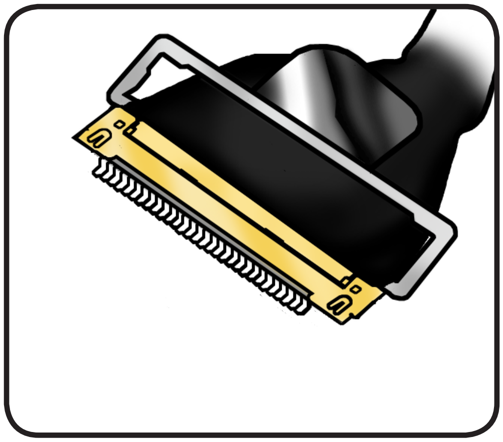
Caution: Do not pull on the black tab or the LVDS lock bar. Pulling on the tab to remove the LVDS cable will likely result in the metal LVDS lock bar being torn off the cable body. This bar is only to be used to disengage the lock from the LVDS connector. A broken lock bar results in a display assembly replacement.



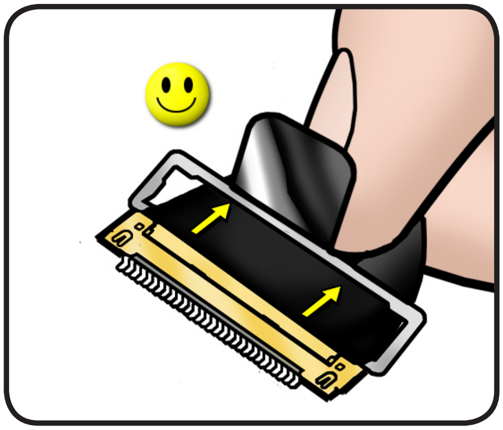
4 Peel EMI gasket off the LVDS cable, toward the fan.

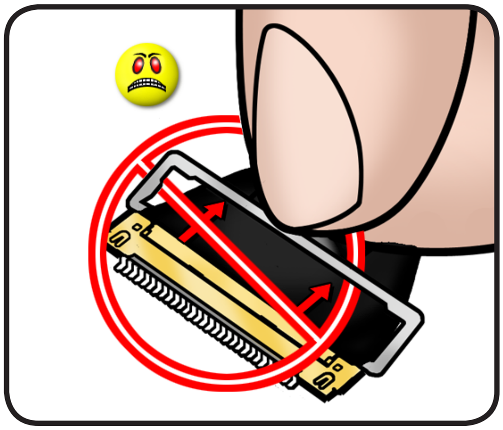
5 To disconnect LVDS cable grasp black tab and gently swing LVDS lock bar up and back to unlock the cable.





6 Slide cable out of connector by pulling the cable. Do not pull the black tab or lock bar.

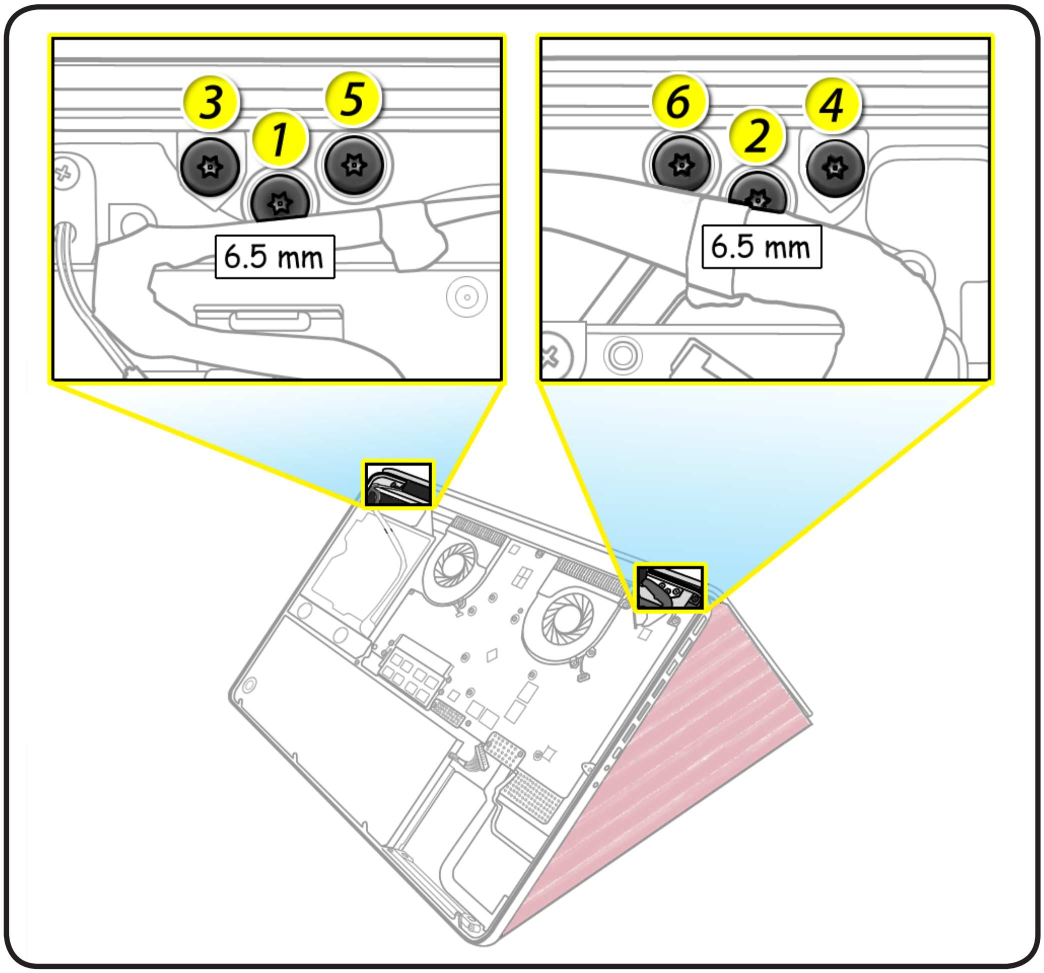




7 Open the display to 90 degrees, and place the computer on the foam wedge service fixture.

8 Remove 6 (6.5-mm) Torx 922-8925 screws:

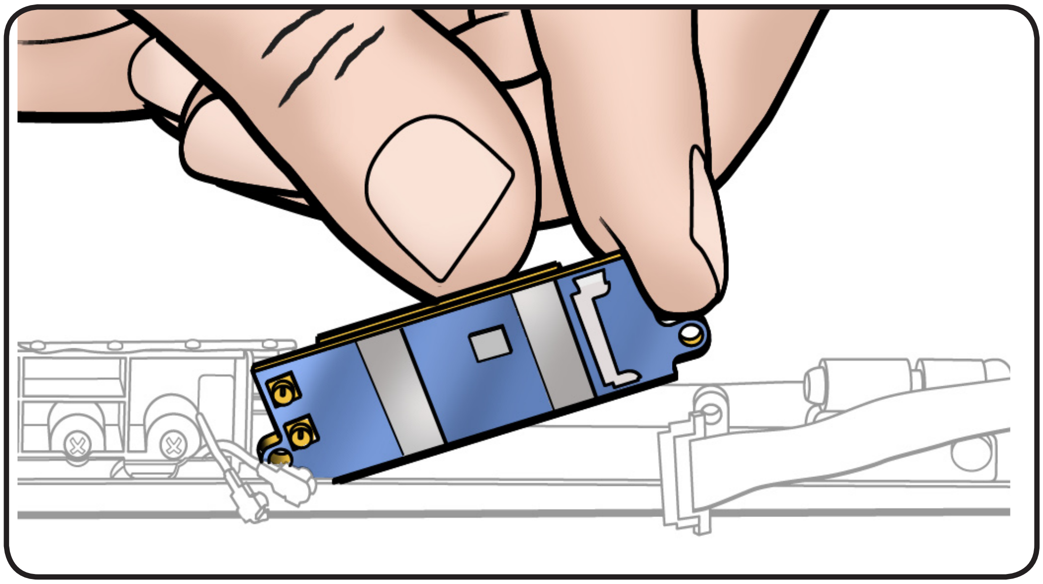
9 Separate display assembly from top case.



Replacement

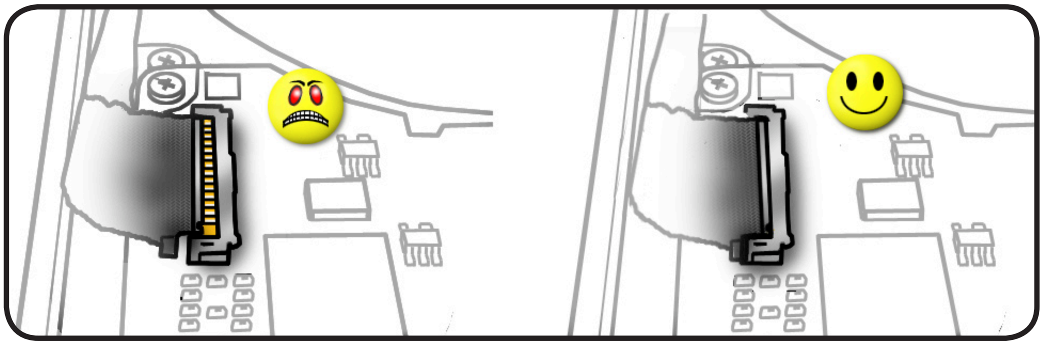
Important: Before returning a display assembly, be sure to

- remove clutch cover
- remove AirPort Card and transfer it to the new display assembly
- reinstall clutch cover
- remove and transfer the protective film from the replacement display to the defective display

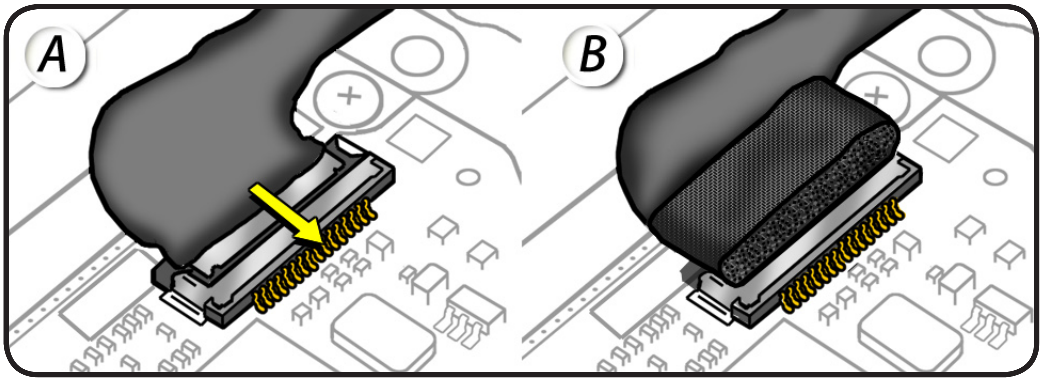


Important: Before installing a new display assembly, be sure to install the AirPort Card. With the computer assembled, test the AirPort card for normal operation.

Replacement Caution: When connecting the LVDS and camera cables, make sure they are fully connected.

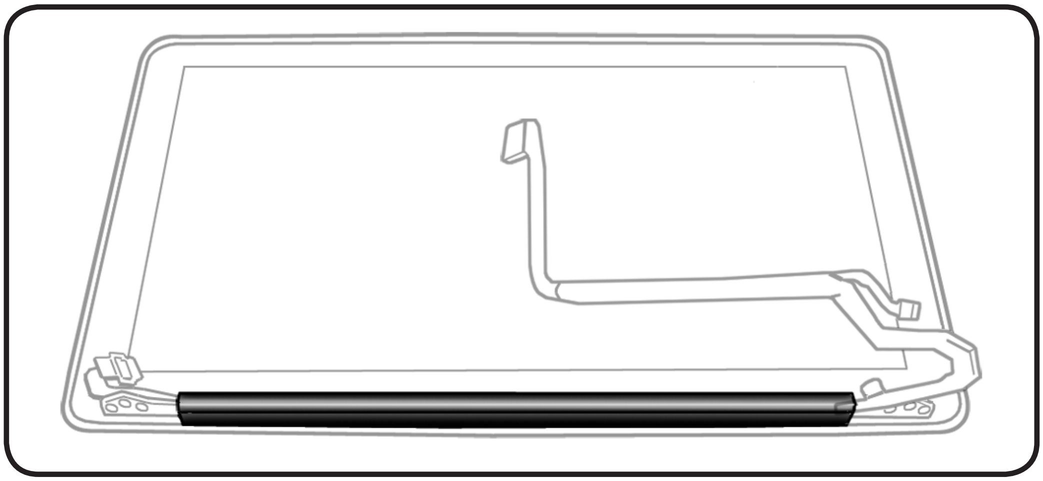


Replacement Caution: To avoid a short to the logic board, be sure to place EMI gasket on camera cable—positioned precisely where shown—**after** cable is fully connected to logic board.



Display Clutch Cover

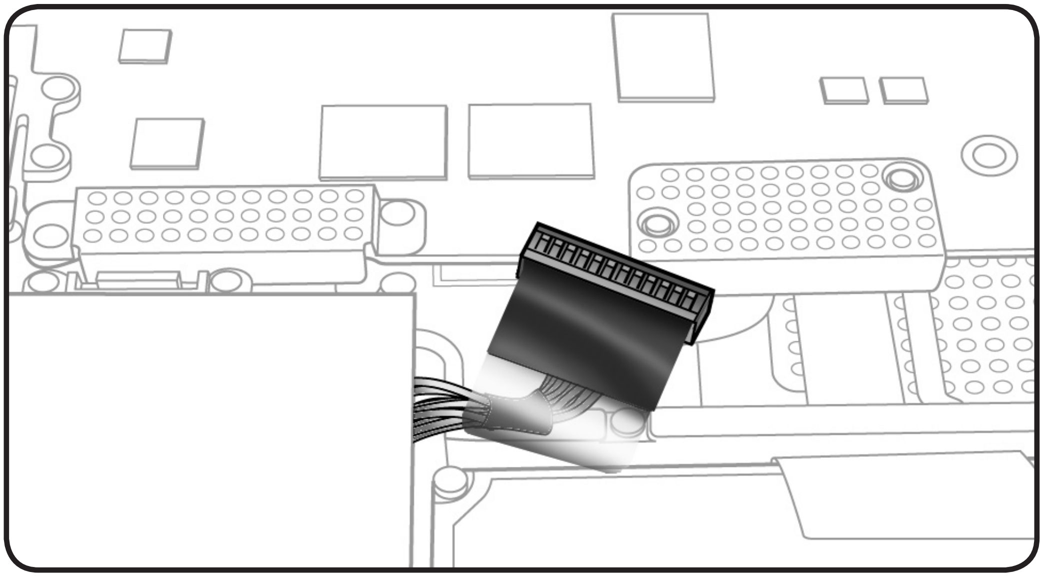
First Steps



Remove:

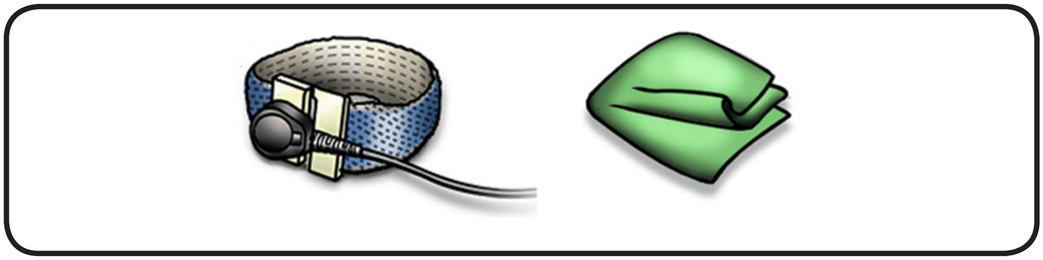
- **Bottom case**
- **Camera cable guide**
- **LVDS cable guide**
- **Display assembly**

Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



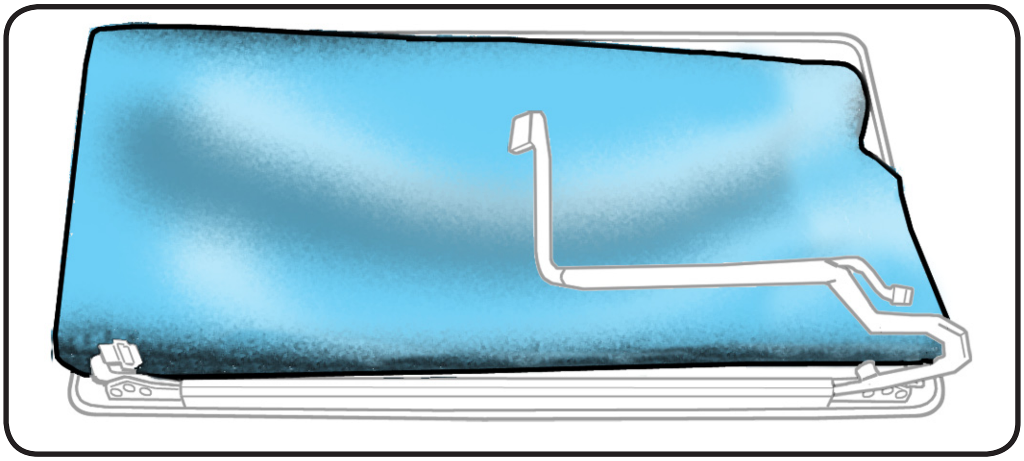
Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat

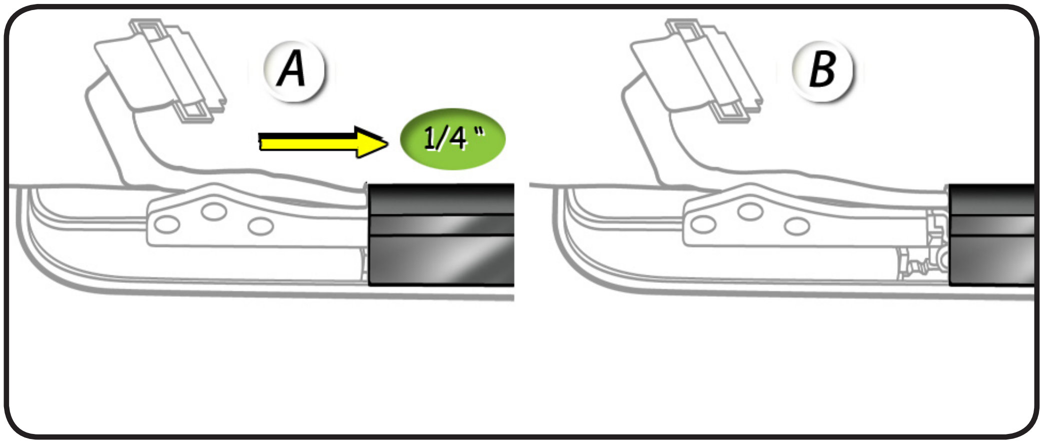


Removal

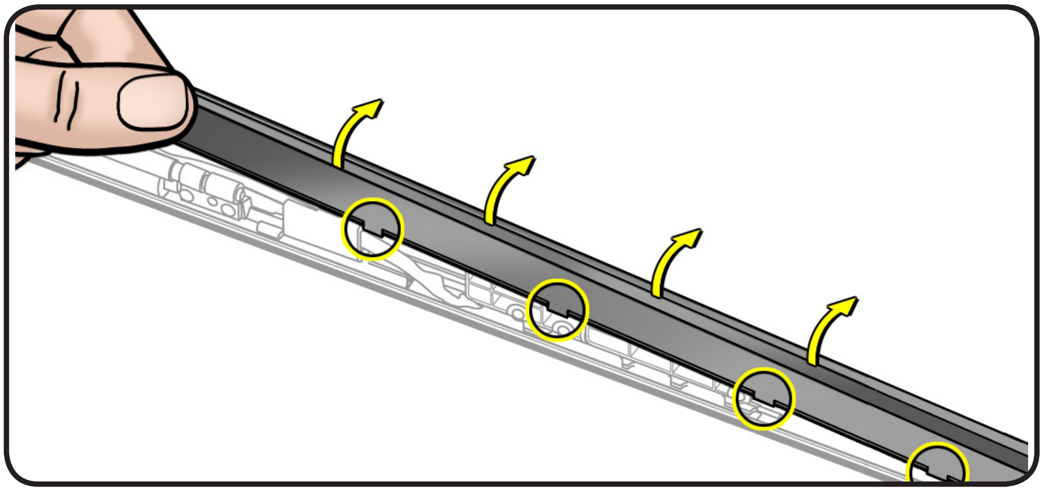
1 Cover display face with clean, soft cloth.



2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from the LVDS cable.

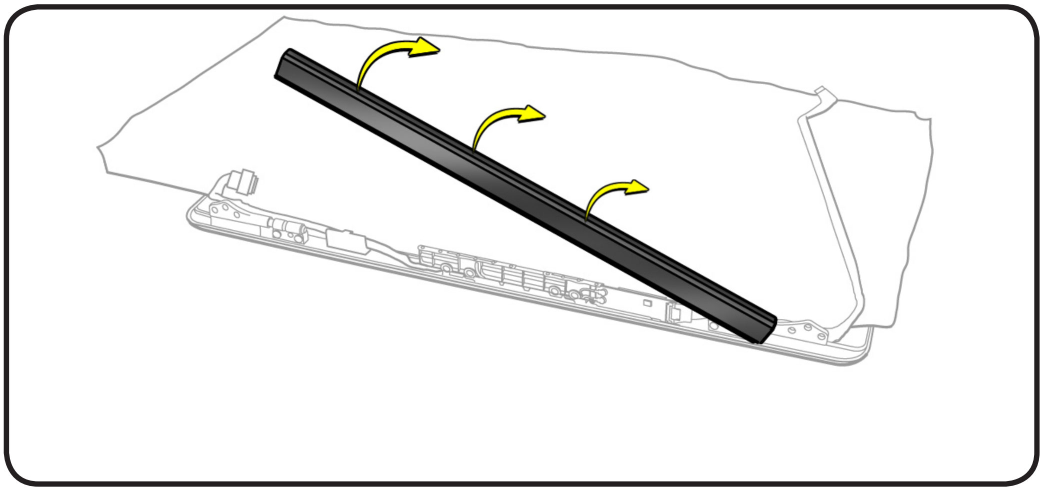


3 Press down on clutch cover to loosen 4 hooks inside.

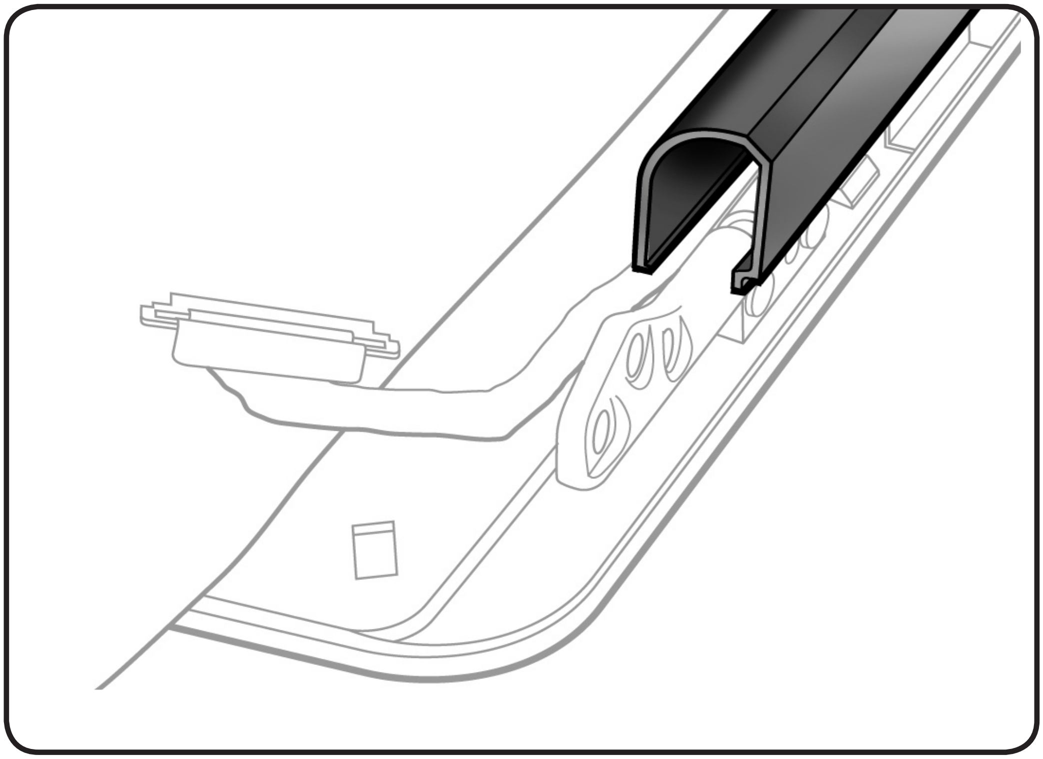


4 Tilt up end of clutch cover as you roll it toward display face.

5 Remove clutch cover.



Replacement



1 Note shape of clutch cover:

- flat at bottom
- curved at top

2 Make sure flat edge is at bottom of display.

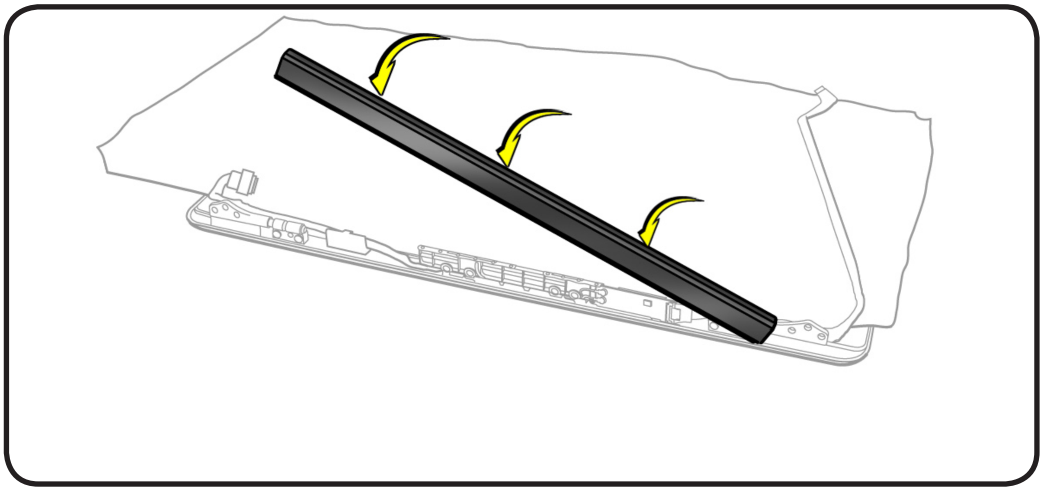
3 Position clutch cover onto end with longer cable.

4 Lower clutch cover onto display assembly.

5 Listen for snapping sound as hooks engage.

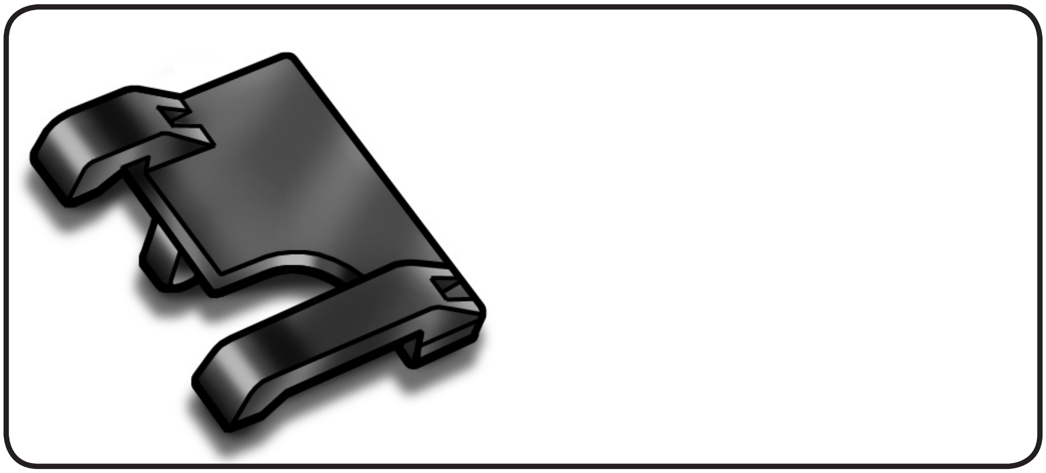
6 Check for good fit. Avoid:

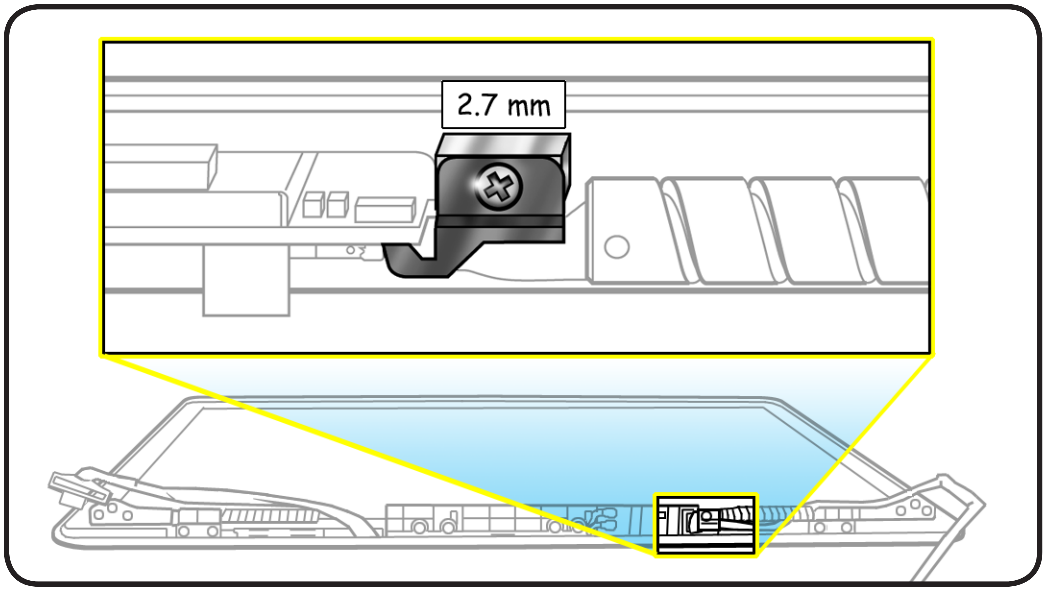
- gaps
- bulges
- pinched cables



Cable Clip for AirPort Card

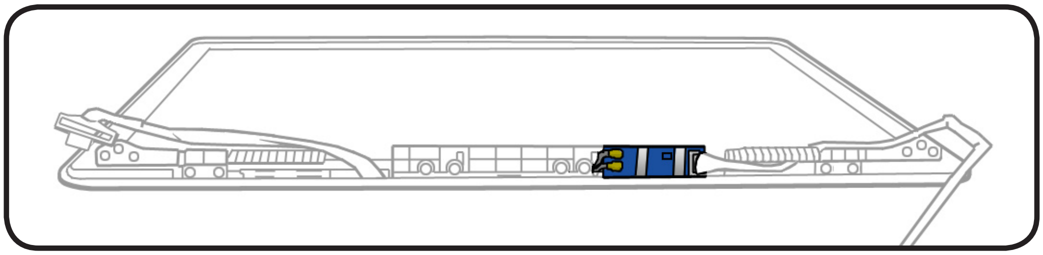
Refer to **AirPort Card**





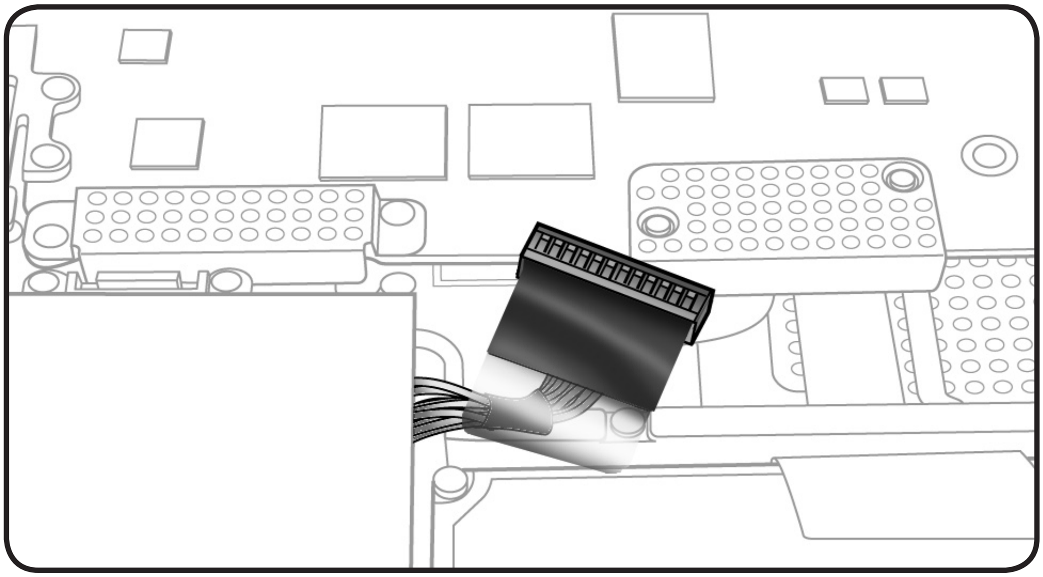
AirPort Card

First Steps



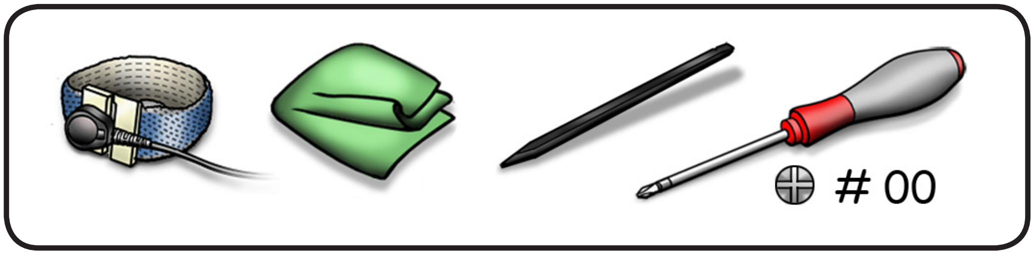
Remove:

- Bottom case
- Camera cable guide
- LVDS cable guide
- Display assembly
- Display clutch cover



Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

Tools

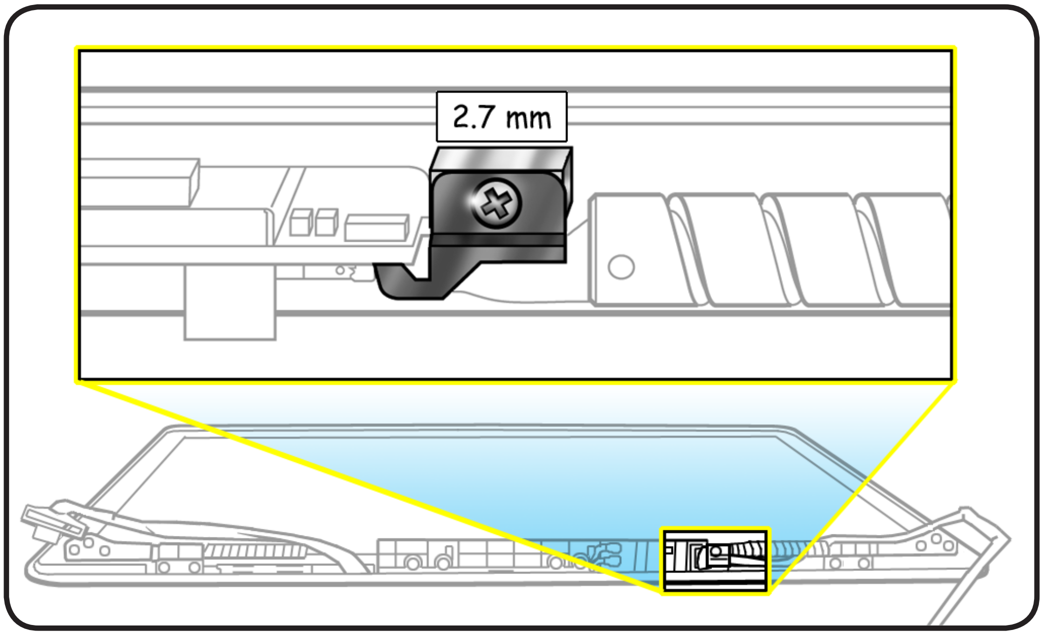


- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver

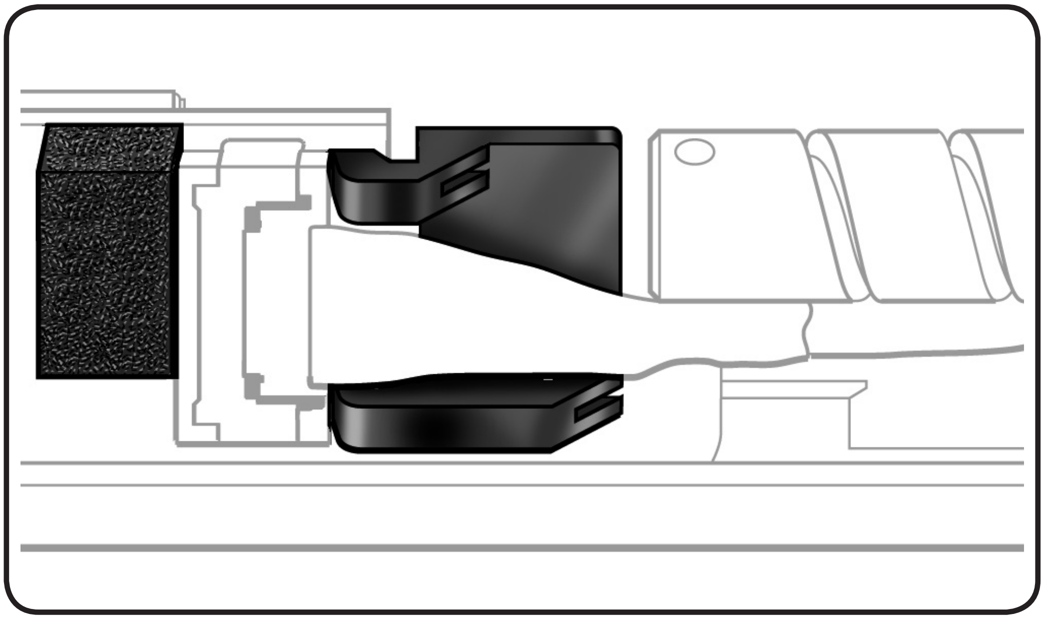
Removal

1 Cover display with clean, soft cloth.

2 Remove 2.7-mm screw (922-8657) from cable clip.

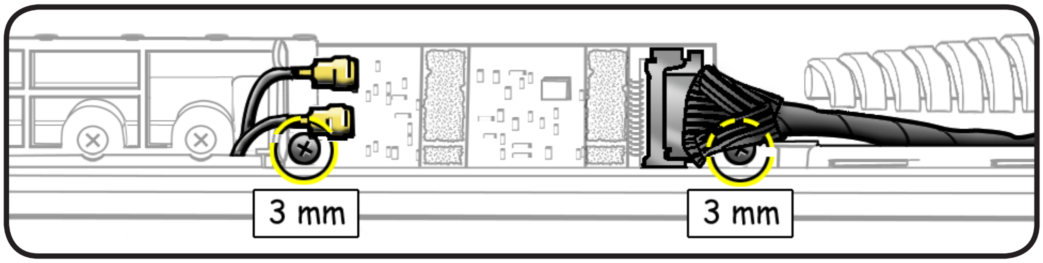


3 Disconnect AirPort cable and remove cable clip.



4 Disconnect 2 AirPort antenna cables using a black stick.

Replacement Note: Shorter antenna is at bottom.

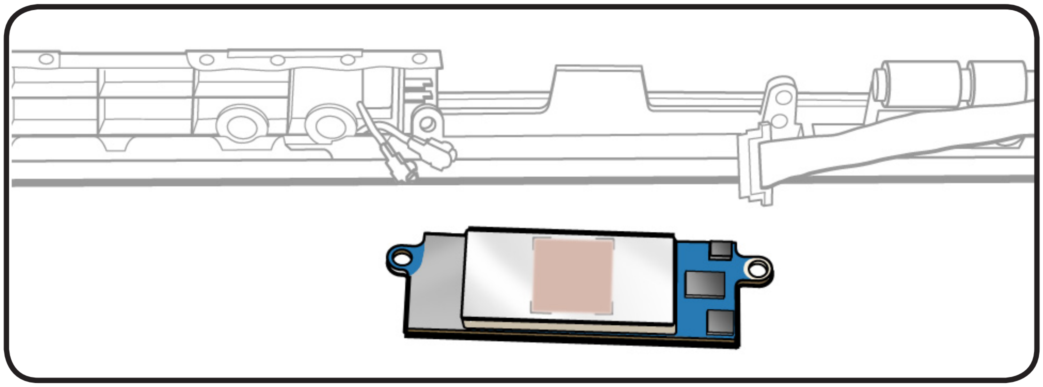


5 Remove 2 (3-mm) screws (076-1343).

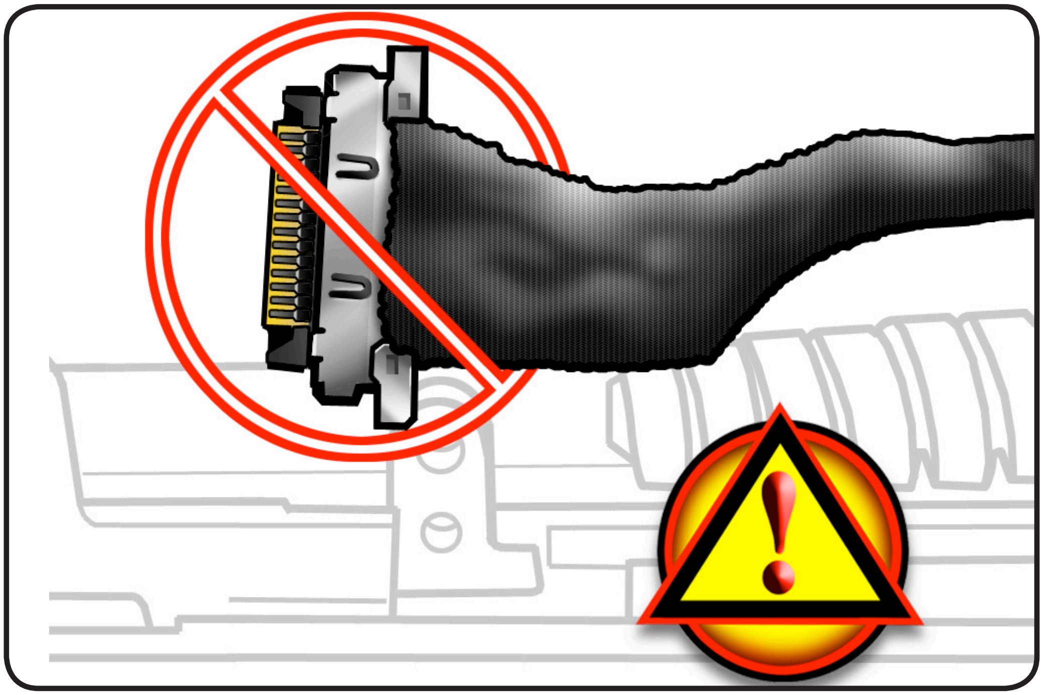
6 Lift out AirPort Card.

Replacement

1 Make sure thermal pad is centered on AirPort Card rather than stuck to display assembly tab.

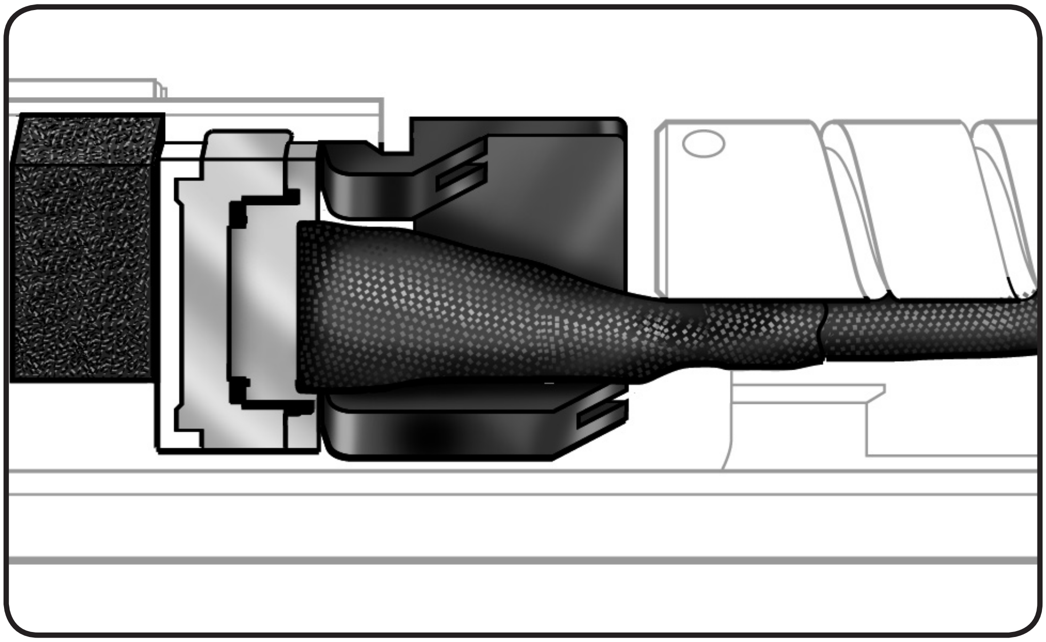


2 **Important**: Check the AirPort cable. Make sure the two "U" marks on the end of the cable are NOT facing up. Inserting the cable with the "U" marks facing up will cause logic board failure. Turn the cable so the unmarked side of the cable is inserted into the AirPort card.

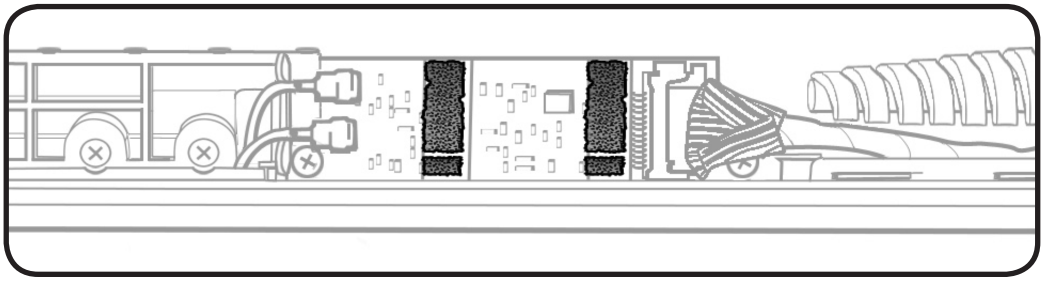


3 Place the cable in the clip before connecting it to the AirPort card.

4 Connect AirPort cable and clip.



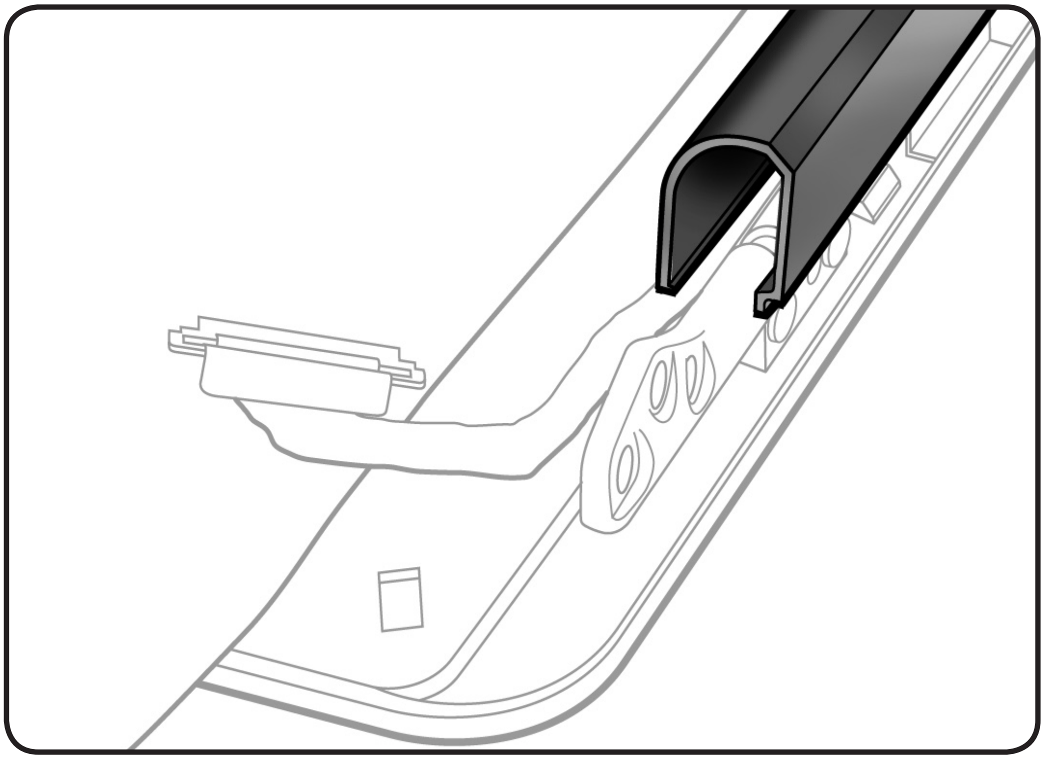
5 Make sure AirPort Card includes 4 foam pads.



6 Replace clutch cover.

7 Reassemble computer.

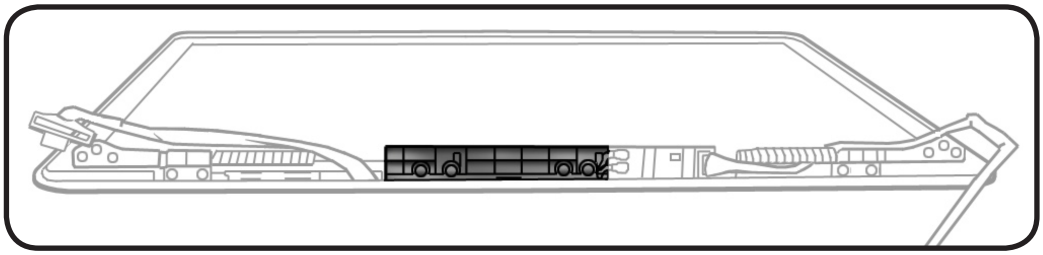
Caution: When testing an AirPort card connection, wait at least 5 seconds after shutdown before connecting the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.



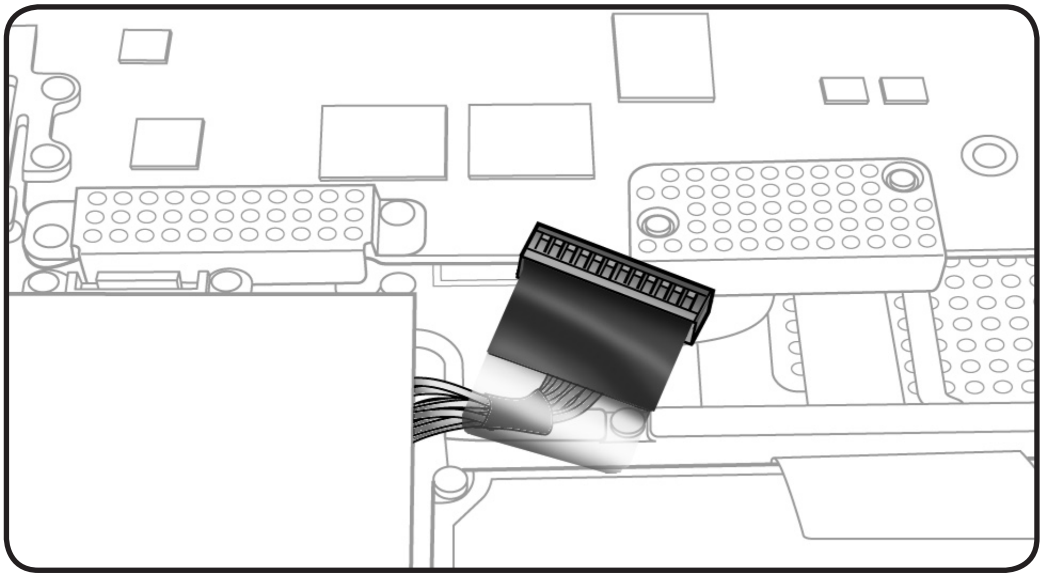
Antenna Board

First Steps

Remove:
- Bottom case
- Camera cable guide
- LVDS cable guide
- Display assembly
- Display clutch cover

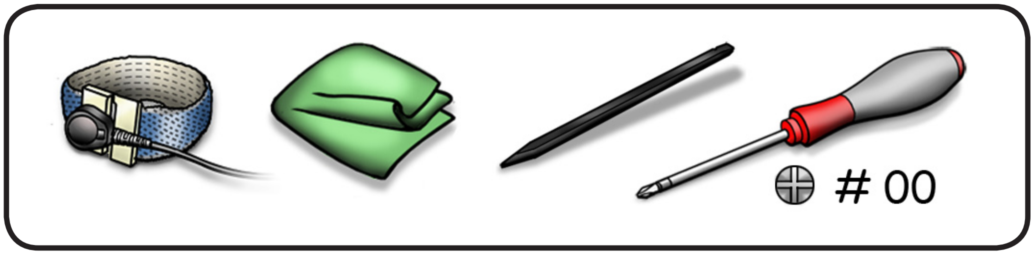


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

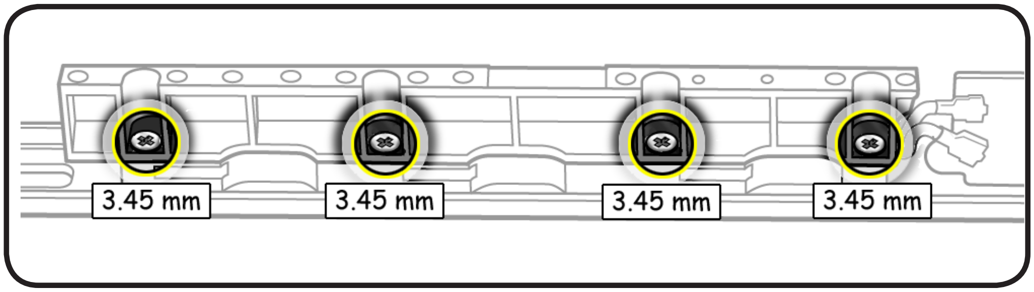


Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver

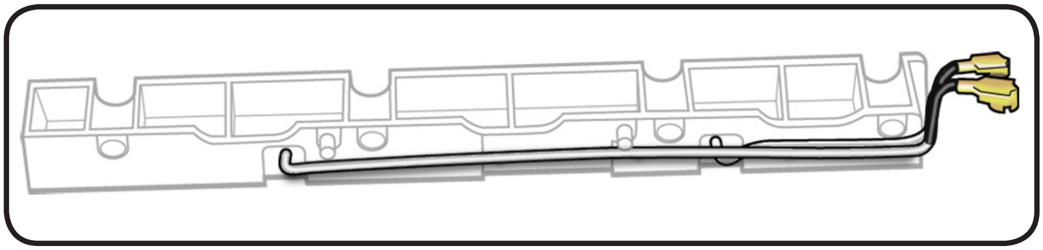


Removal



1. Remove 4 (3.45-mm) screws (922-xxxx).
2. Lift out antenna board.

Replacement



1. Make sure the AirPort antenna cable is routed in its channel.
2. Set the antenna board in the display assembly and install the screws.
3. Connect the 2 ends of the antenna cable to the AirPort card:

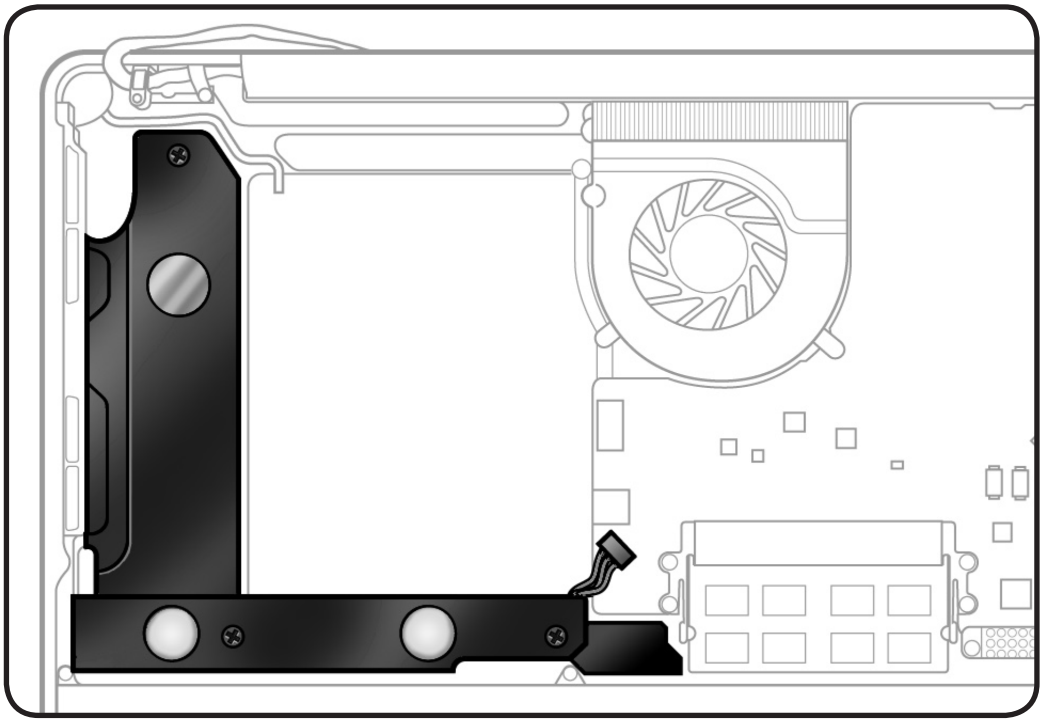
- longer cable (top)
- shorter cable (bottom)

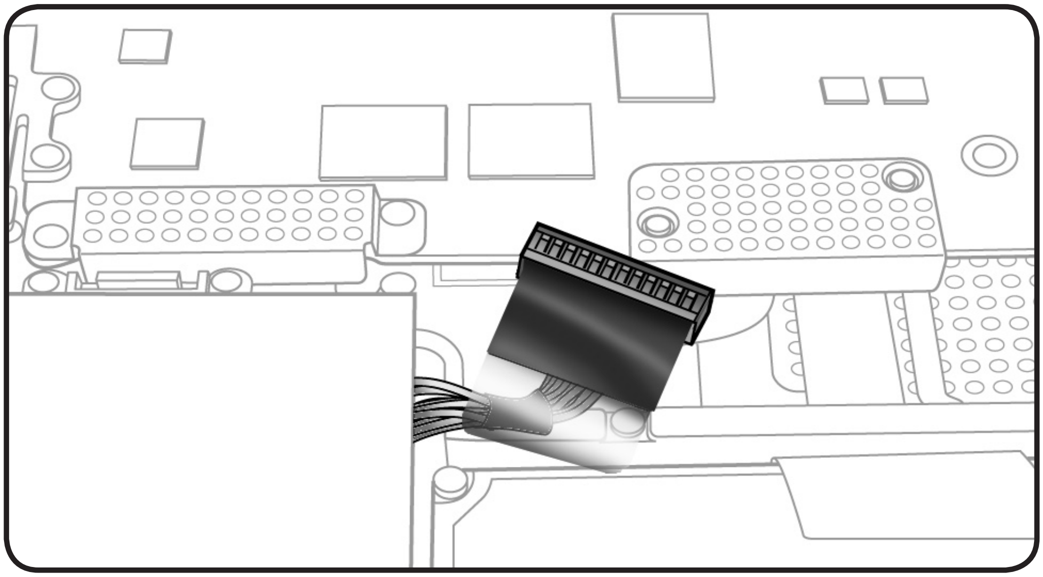
Right Speaker/Subwoofer

First Steps

Remove:

- **Bottom case**
- **Optical drive**

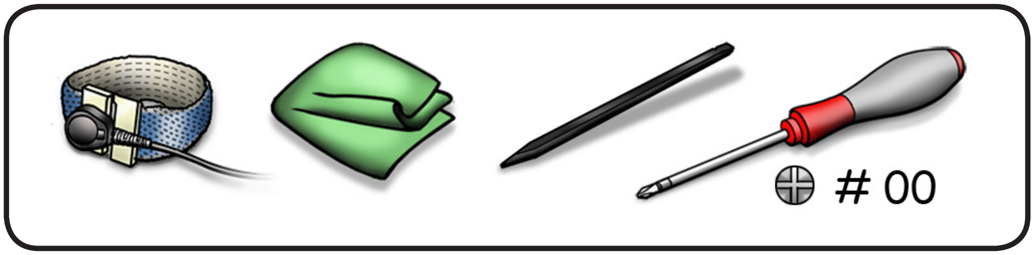




Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver

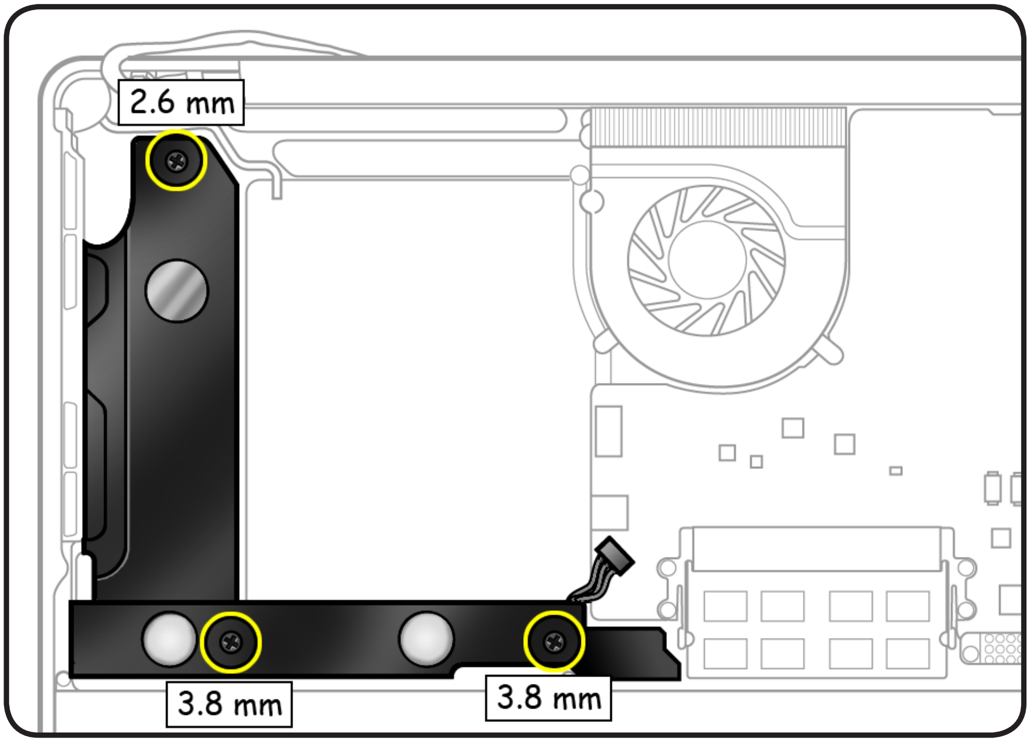


Removal

1 Remove 3 screws:

- 1 (2.6-mm) 922-8662
- 2 (3.8-mm) 922-xxxx

2 Disconnect speaker cable from logic board.

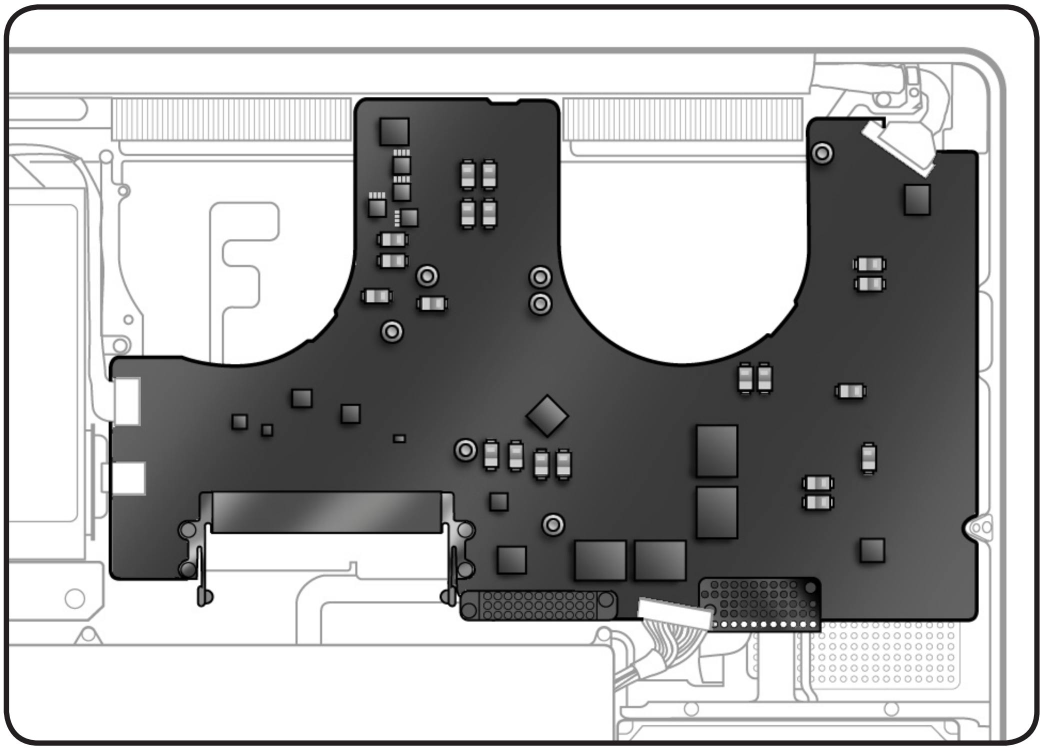


Logic Board

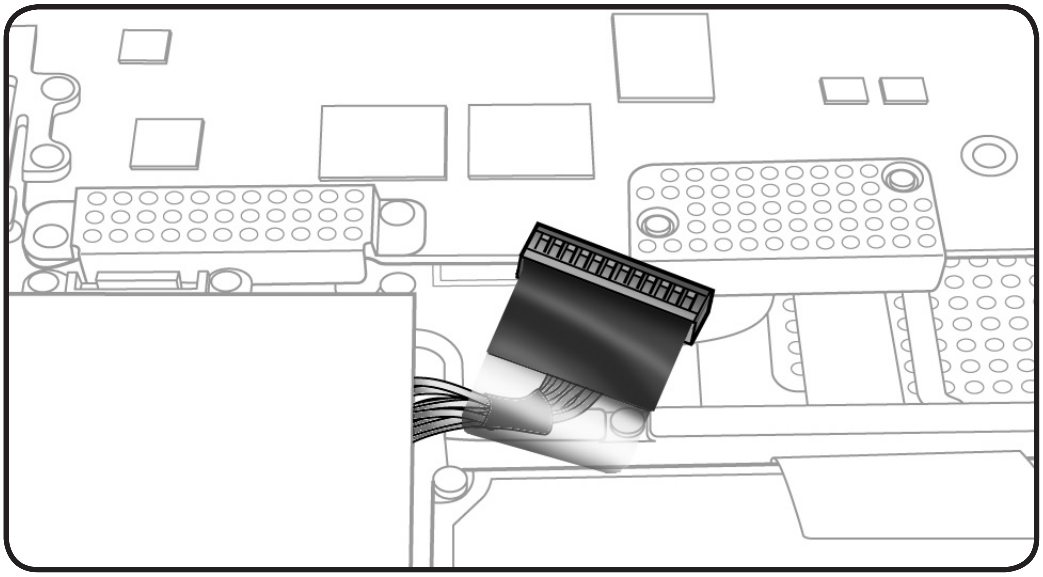
First Steps

Remove:

- **Bottom case**
- **Memory**
- **Fans**

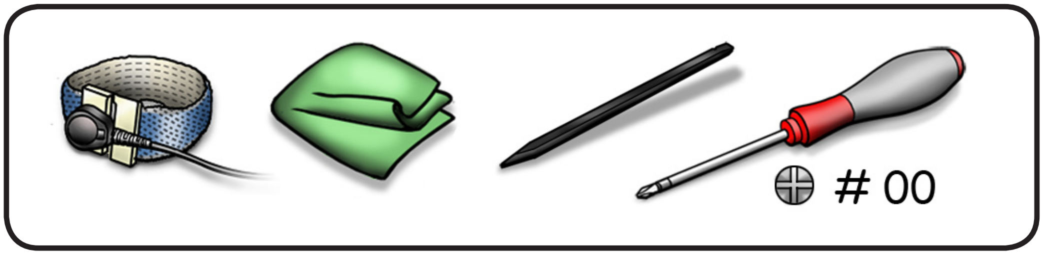


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver

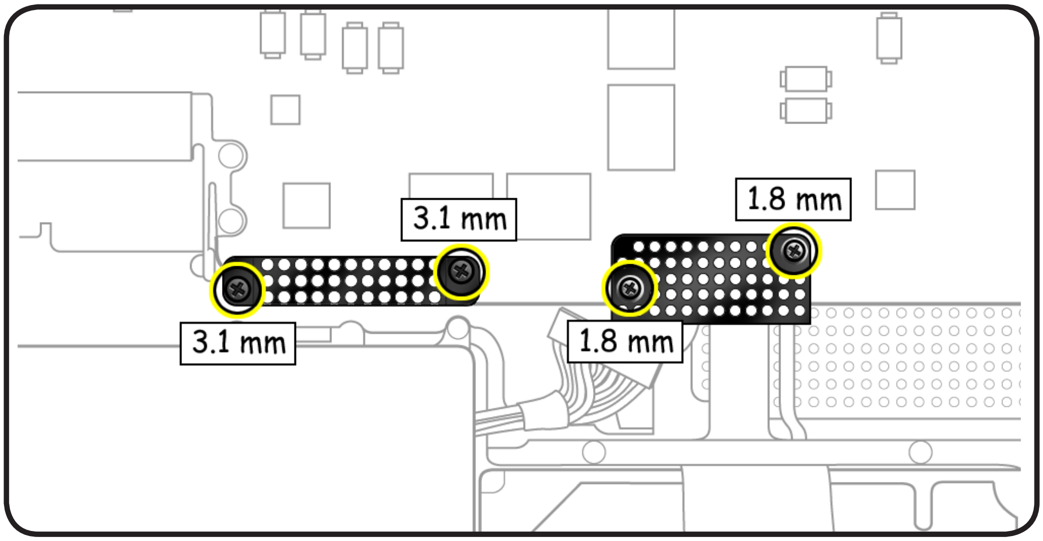


Removal

1 Remove 4 screws:

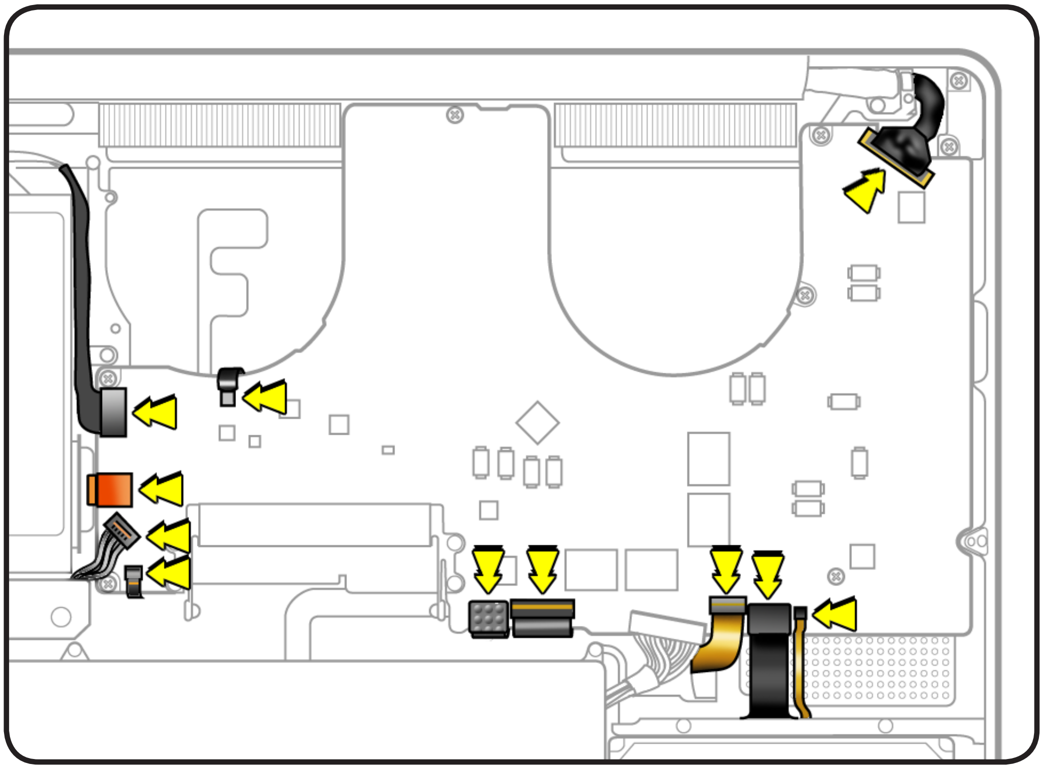
- 2 (3.1-mm) 922-8983
- 2 (1.8-mm) 922-xxxx

2 Lift away 2 shields.



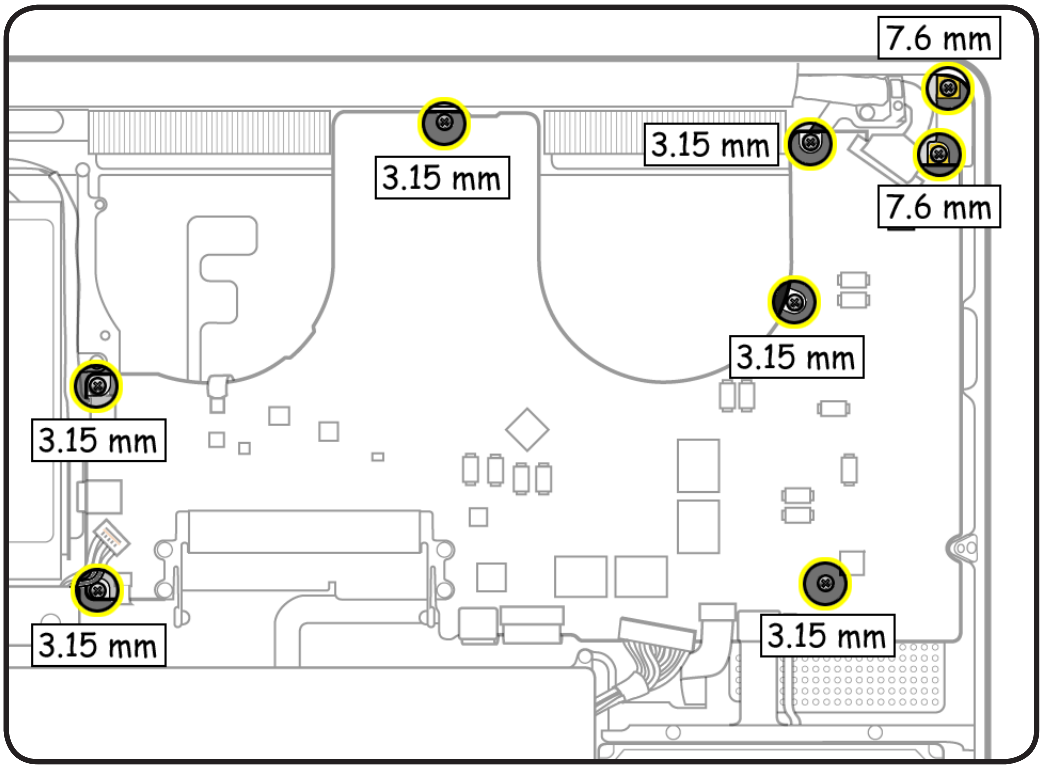
3 Refer to **Connector Types** to carefully disconnect 11 cables:

- LVDS
- keyboard backlight
- camera
- optical drive
- right speaker
- IR/sleep
- trackpad
- keyboard
- Express card cage
- hard drive connector
- battery indicator light (BIL)

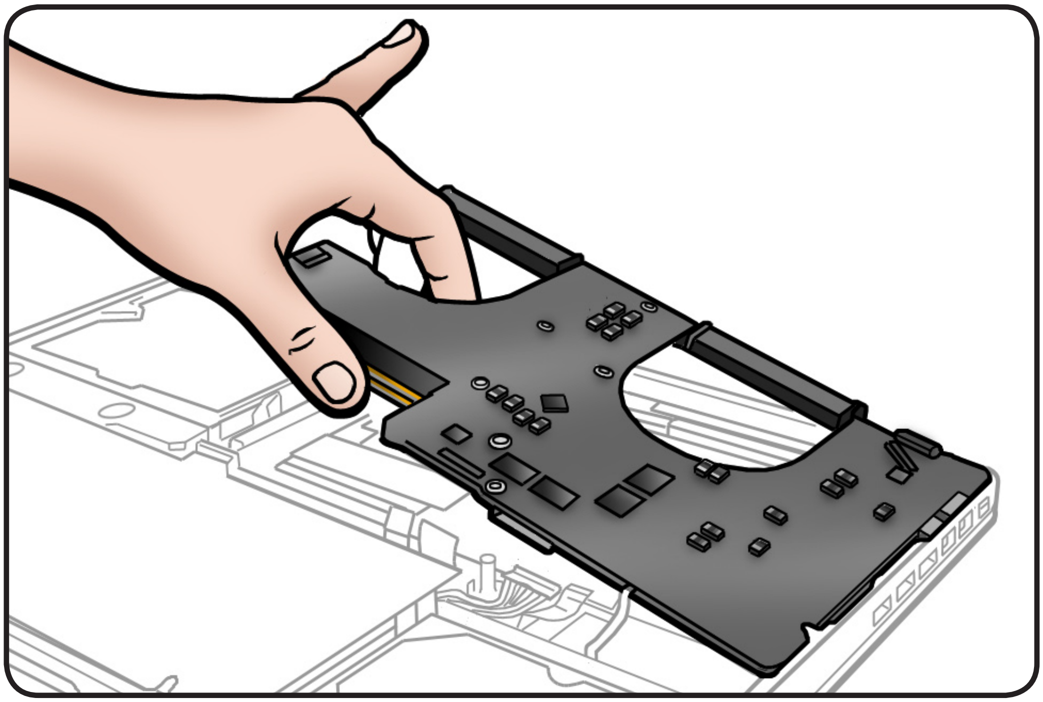


4 Remove 8 screws:

- 2 (7.6-mm) 922-8929 from MagSafe board
- 6 (3.15-mm) 922-8754 from logic board


7.6 mm
3.15 mm
3.15 mm
7.6 mm
3.15 mm
3.15 mm
3.15 mm
3.15 mm

5 Tilt logic board away from ports to remove it.



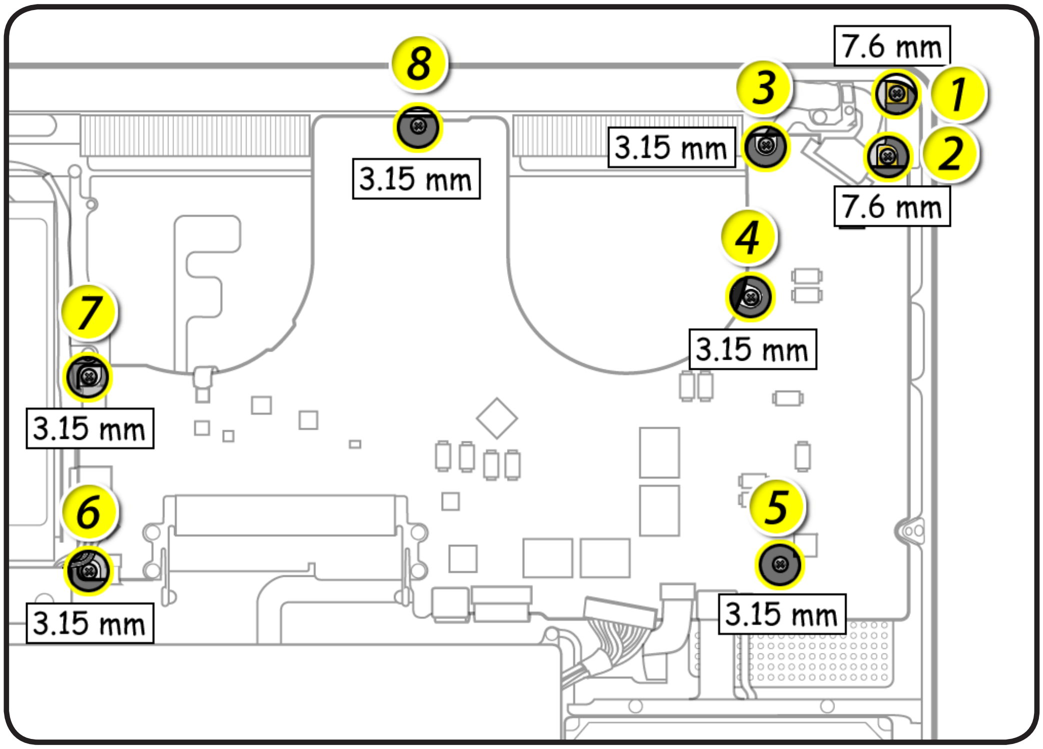
Replacement

If replacing the logic board with a new one, transfer:

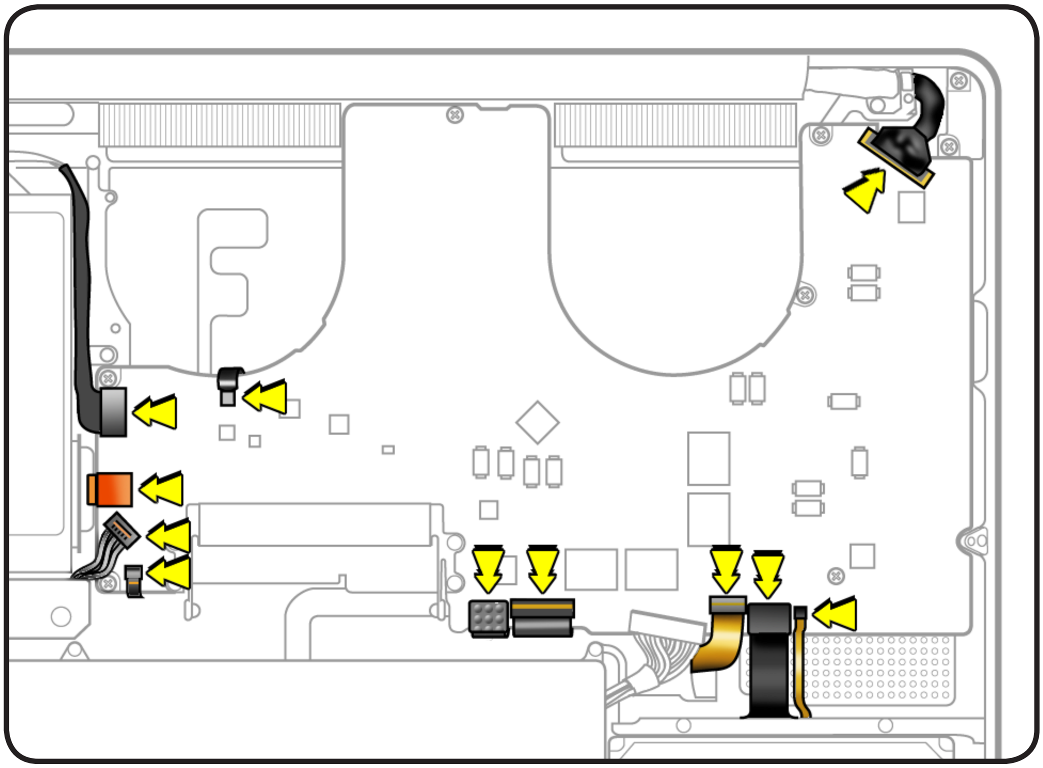
- left speaker
- microphone cable
- heatsink
- MagSafe board
- memory

1 Install MagSafe board.

2 Keeping all cables away, install logic board screws in order shown.


7.6 mm
8
3
1
3.15 mm
3.15 mm
2
7.6 mm
4
7
3.15 mm
3.15 mm
6
5
3.15 mm
3.15 mm

Connect cables following the instructions in **Connector Types**.

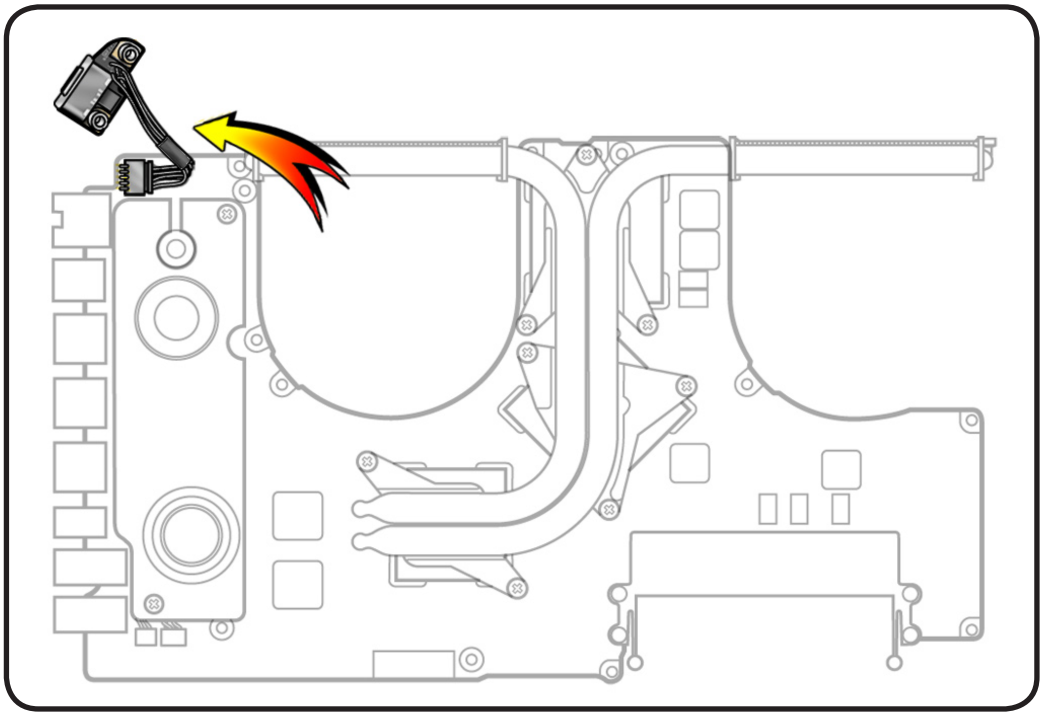


MagSafe Board

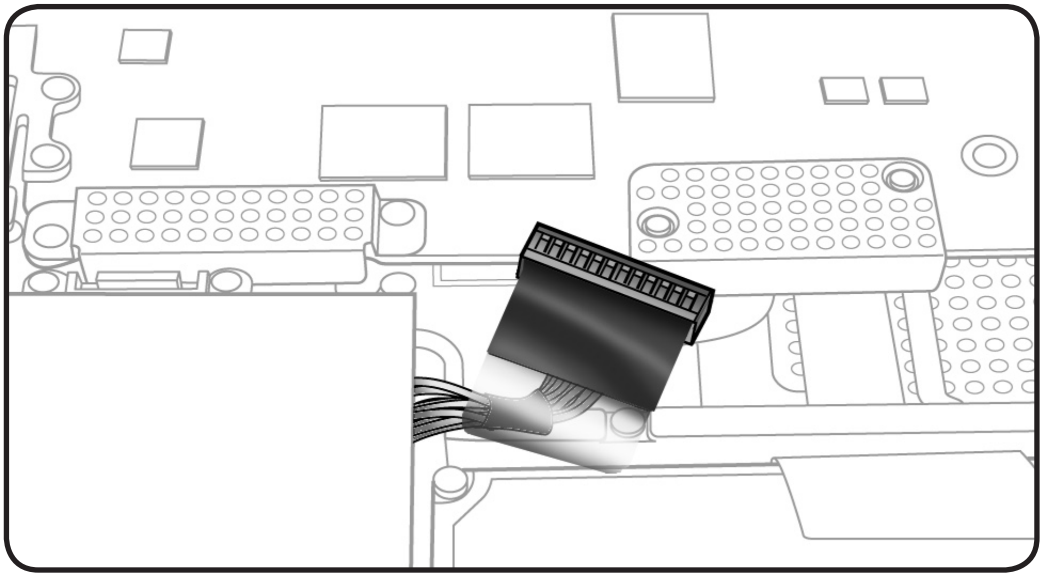
First Steps

Remove:

- **Bottom case**
- **Memory**
- **Fans**
- **Logic board**

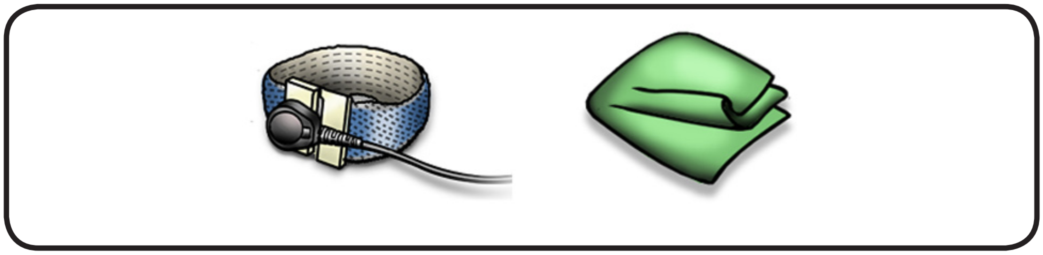


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat

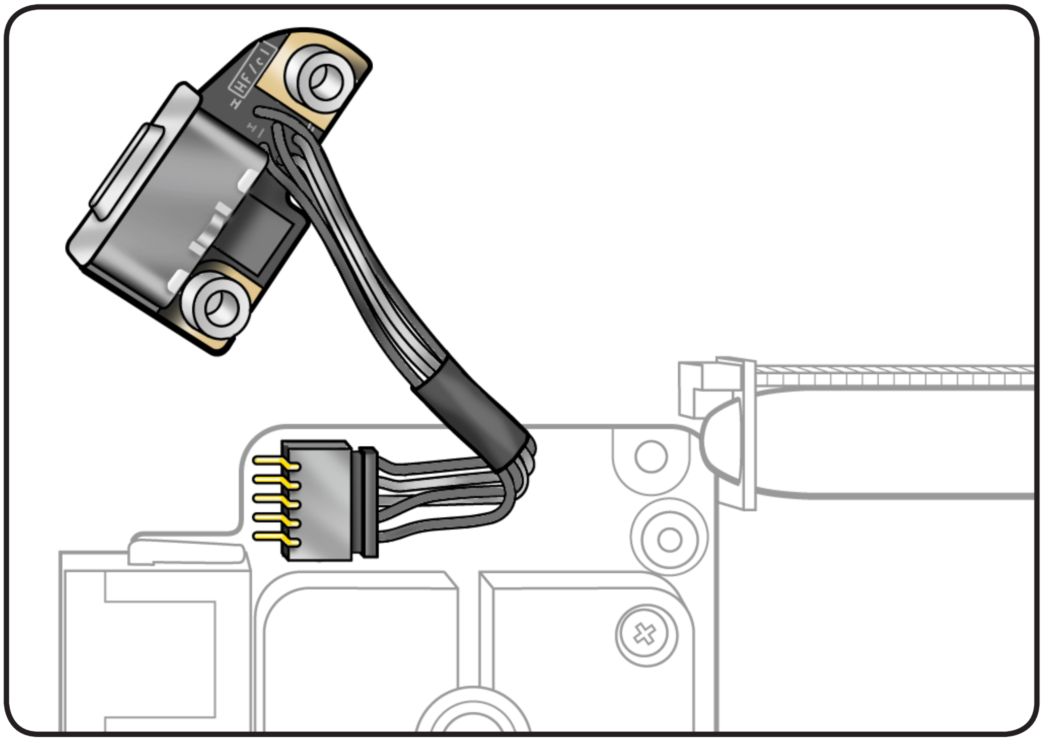


Removal

Disconnect MagSafe cable from underside of logic board:

Replacement Note: Refer to **Logic Board** to connect MagSafe board before lowering logic board in place.

Replacement Note: After installing the MagSafe screws, check the port connection by plugging in a disconnected power adapter cable. If the MagSafe port is off center, the cable will not plug in securely, and you must reinstall the MagSafe board.

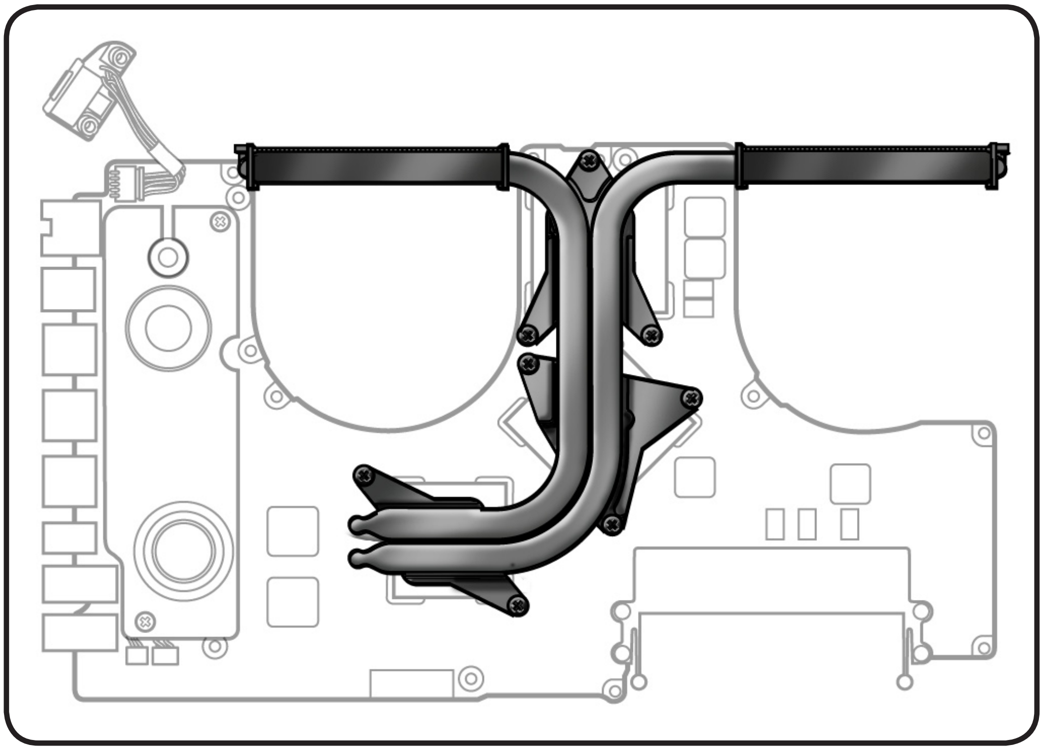


Heatsink

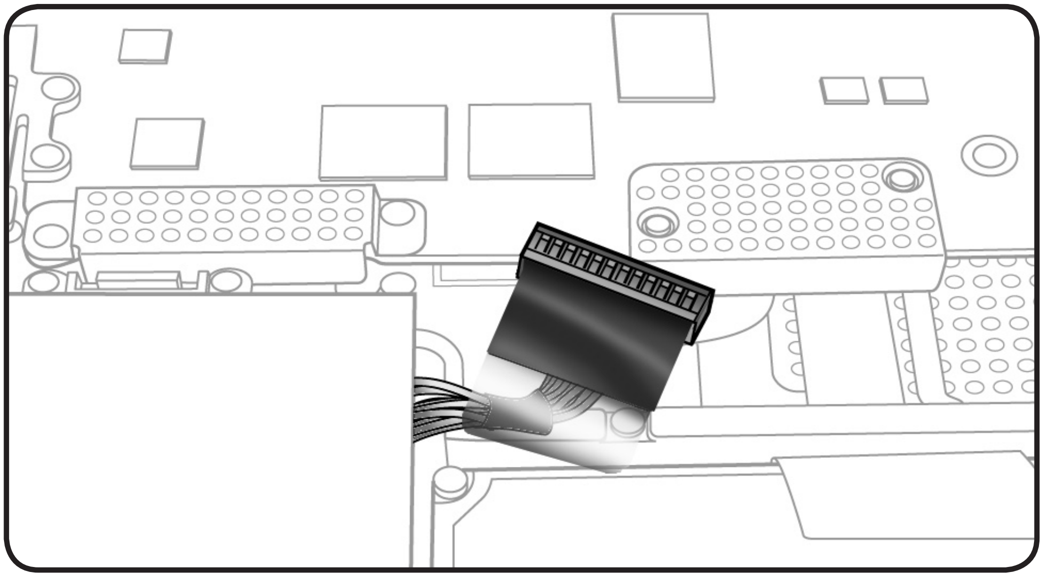
First Steps

Remove:

- **Bottom case**
- **Memory**
- **Fans**
- **Logic board**

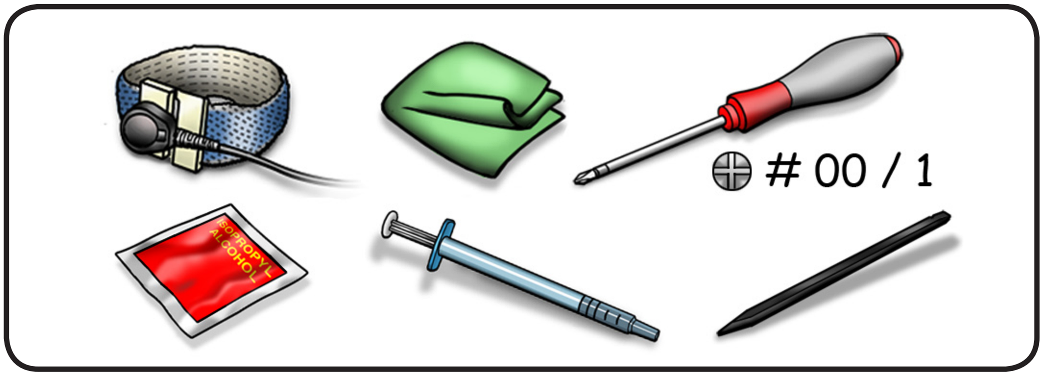


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

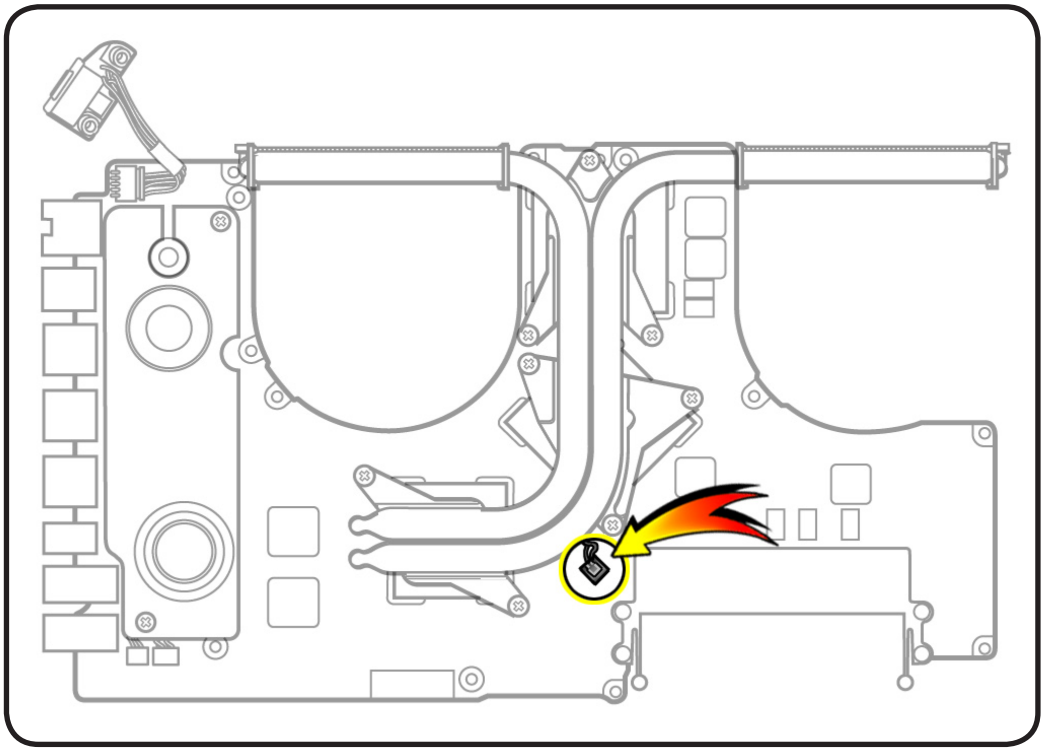
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #0 or #1 screwdriver
- Thermal grease syringe
- Alcohol pads
- Black stick



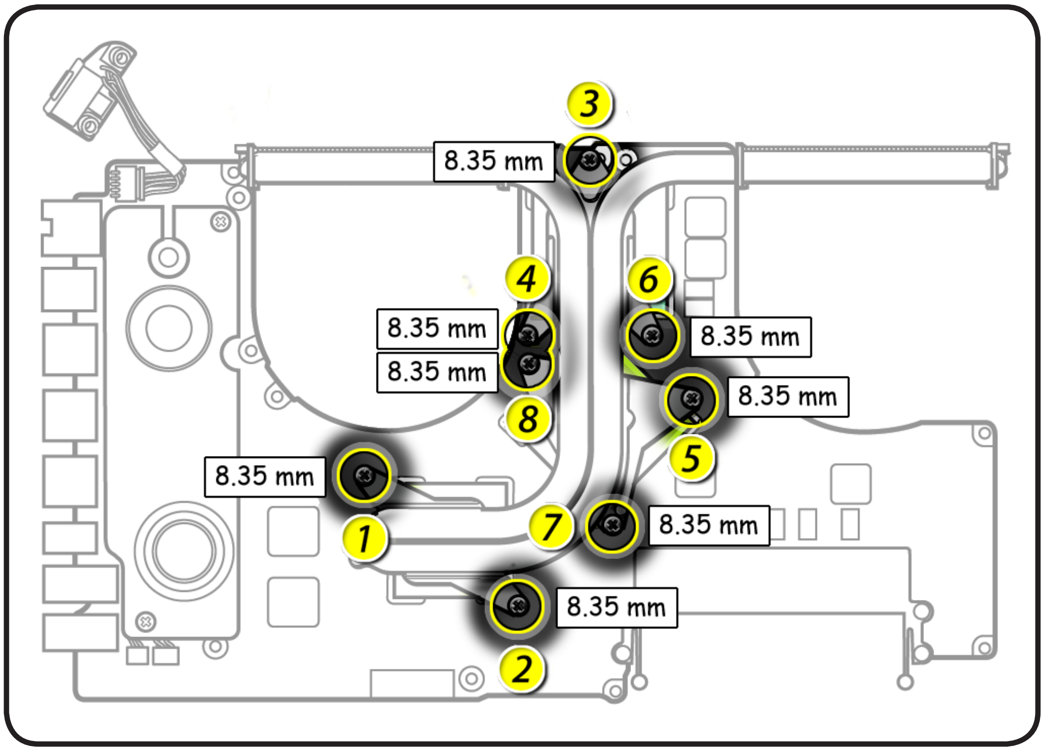
Removal

Caution: Hold heatsink by edges, not by the heat pipes:

1 Disconnect the thermal sensor cable using a black stick.

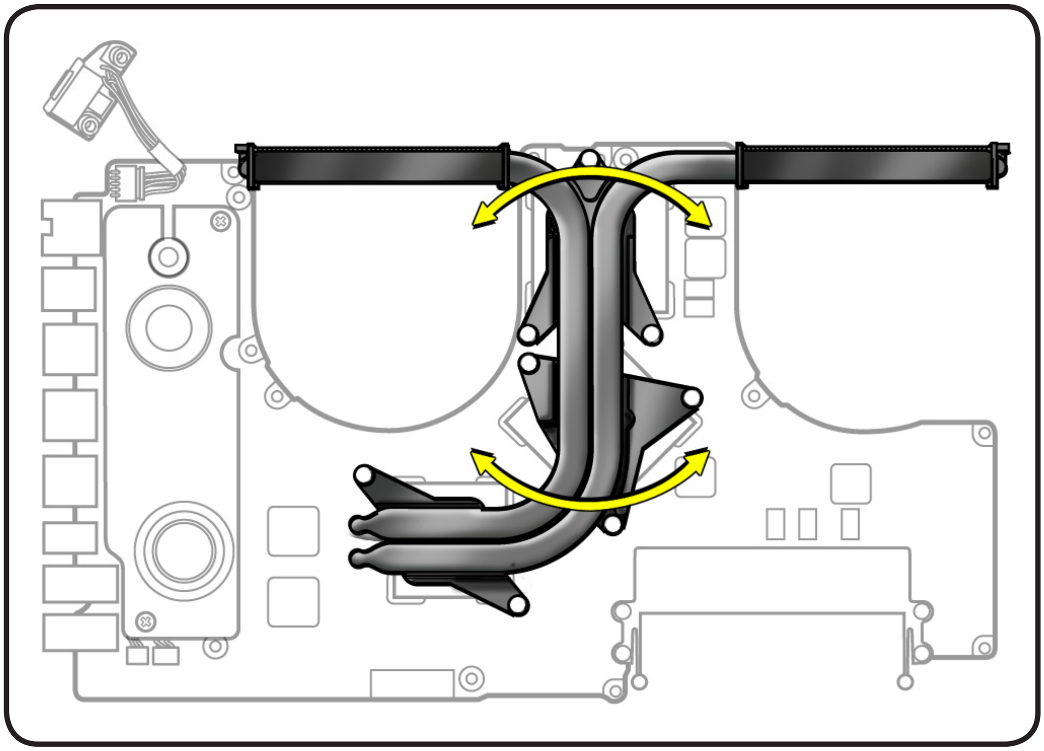


2 Remove 8 (8.35-mm) 922-8799 screws.

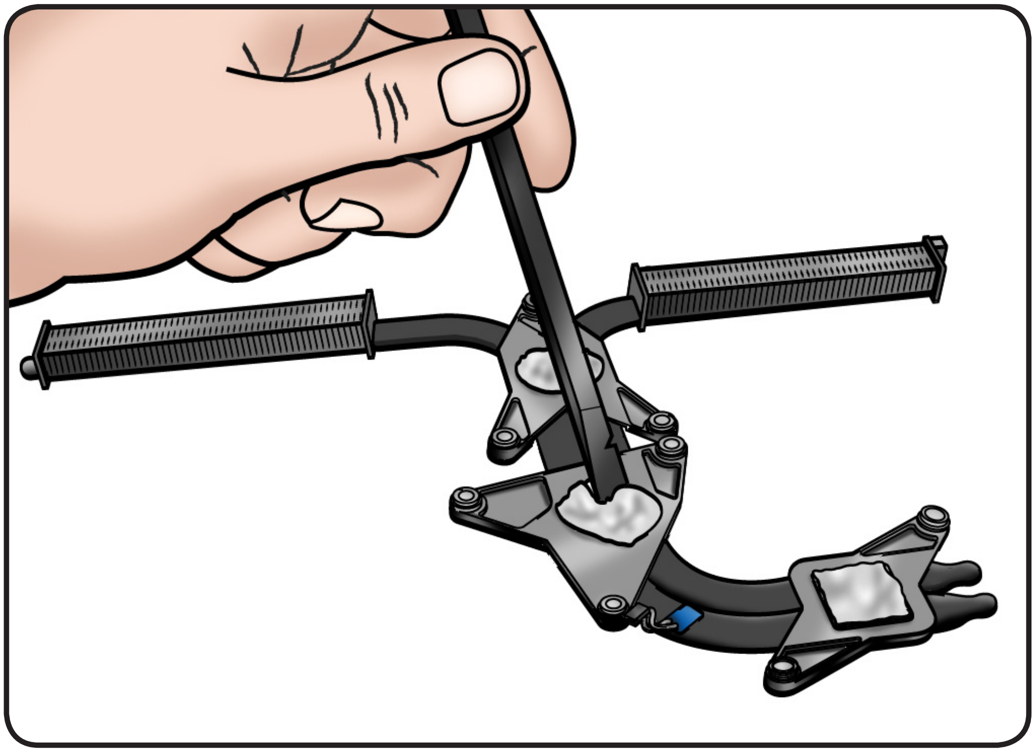


3
8.35 mm
4
6
8.35 mm
8.35 mm
8.35 mm
8.35 mm
8
5
8.35 mm
1
7
8.35 mm
8.35 mm
2

3 Keeping heatsink parallel to logic board, gently wiggle the heatsink to loosen the bond to the board.



4 With a black stick, scrape off thermal grease and use alcohol pad to clean thermal pads and microprocessors.

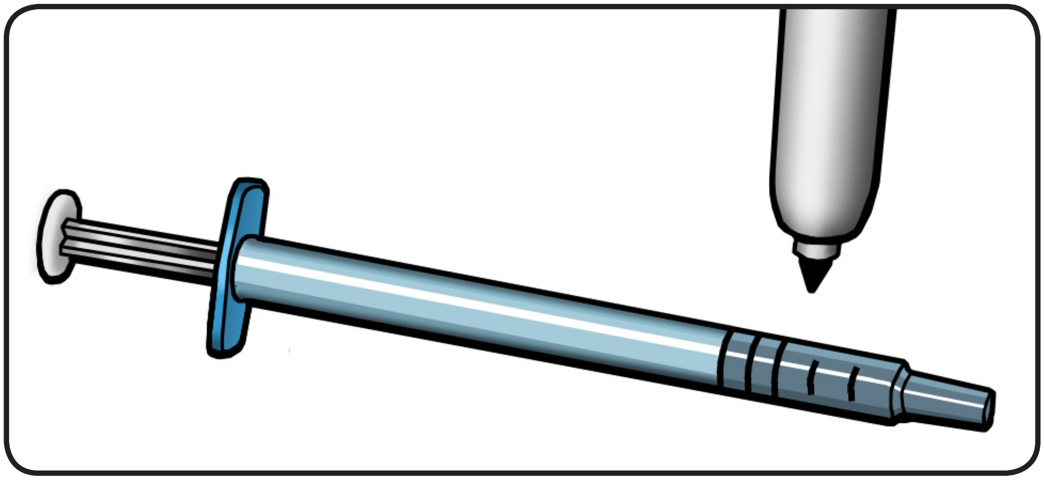


Replacement

Important: New heatsinks include pre-applied thermal grease. Follow steps 1-2 only if re-installing the original heatsink.

1 **Caution:** The syringe contains enough thermal grease for 3 microprocessors.

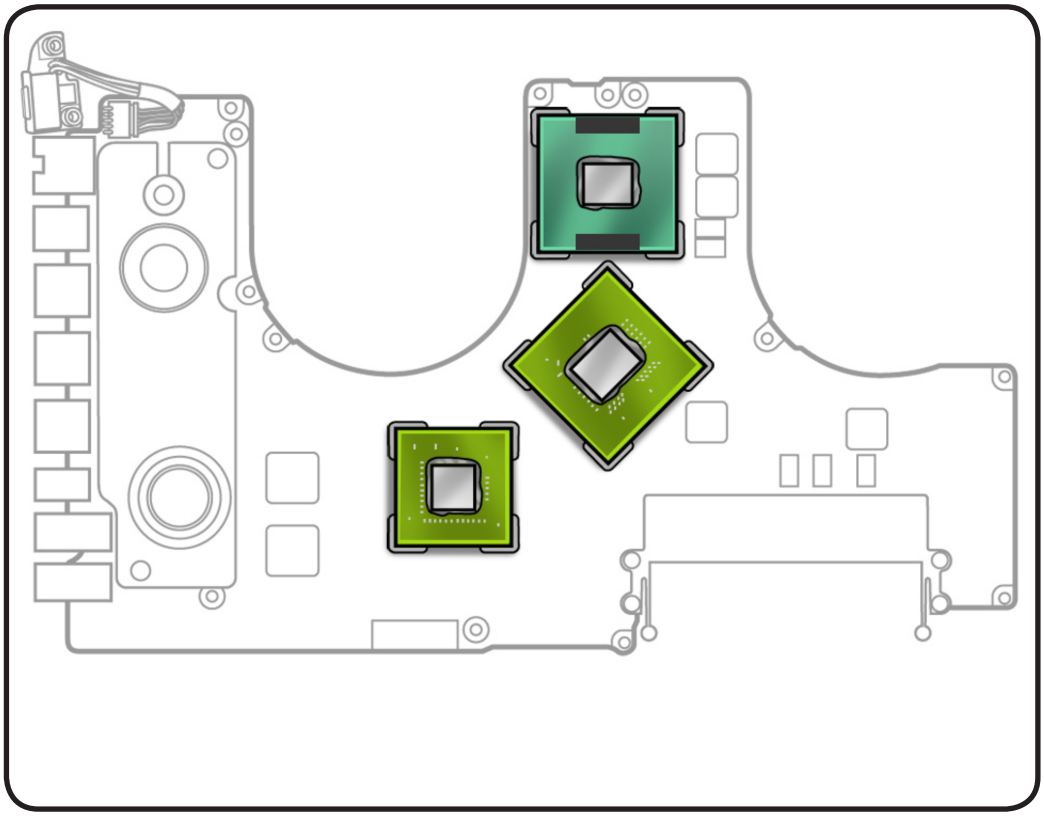
Use a pen to mark the syringe in thirds.



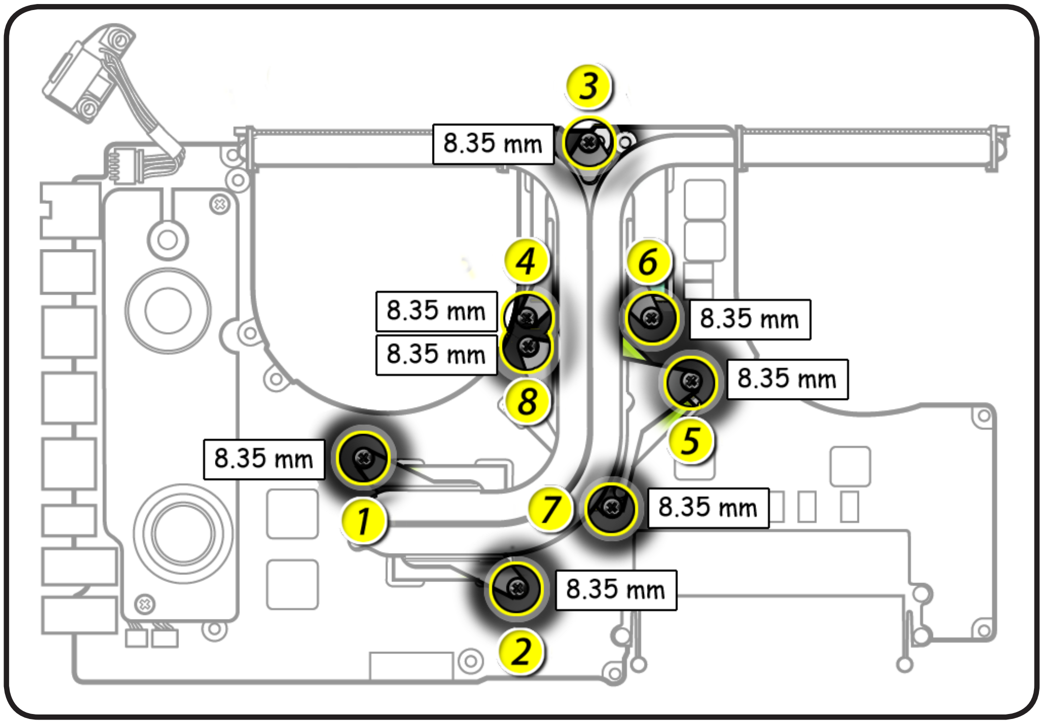
2 Inject 1/3 of grease on the center of each microprocessor.

3 **Important**: Connect the thermal sensor. The computer will not function with the sensor disconnected.

4 Lower the heatsink over the logic board.



5 Install heatsink screws in order, 1/2 way first, then tighten the rest of the way.

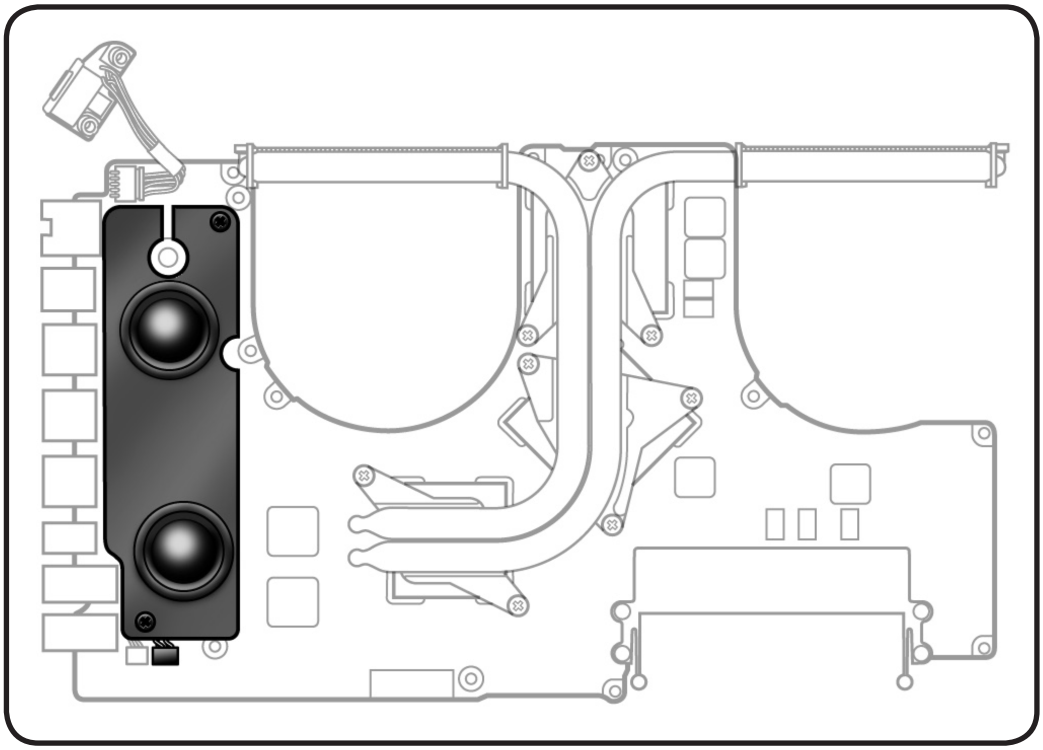

3
8.35 mm
4
6
8.35 mm
8.35 mm
8.35 mm
8.35 mm
8
5
8.35 mm
7
8.35 mm
1
8.35 mm
2

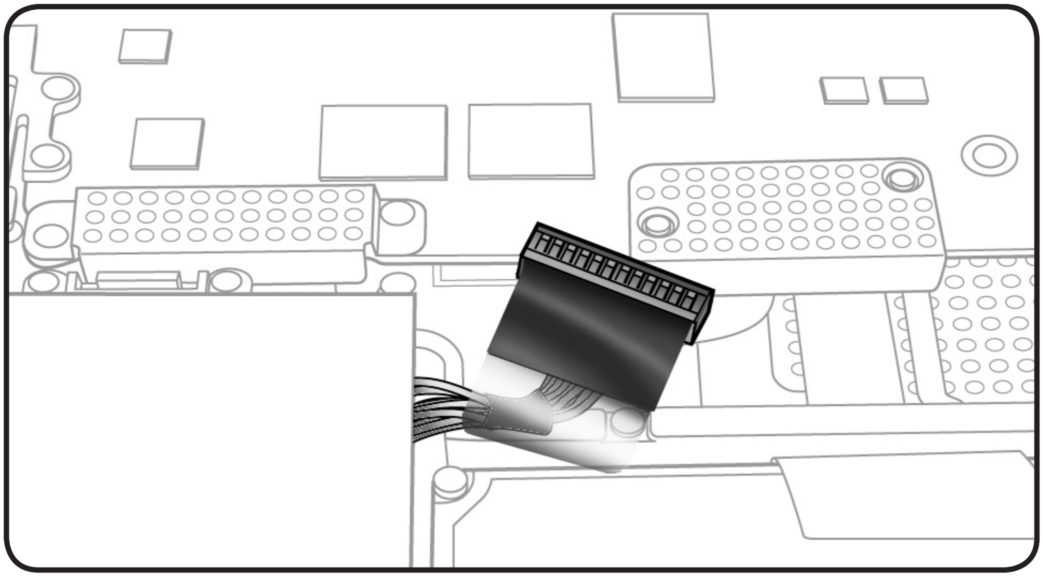
Left Speaker

First Steps

Remove:

- Bottom case
- Memory
- Fans
- Logic board

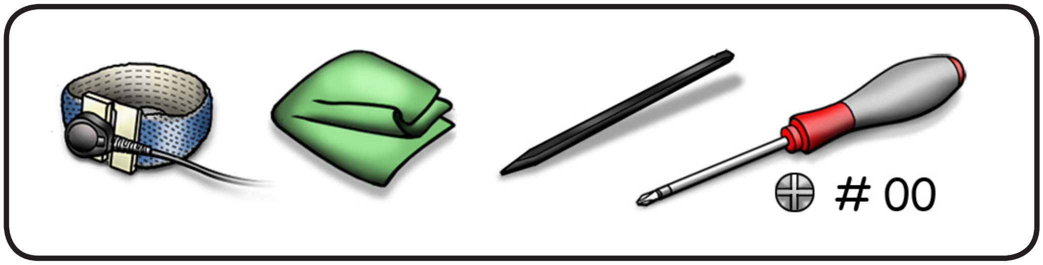




Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick

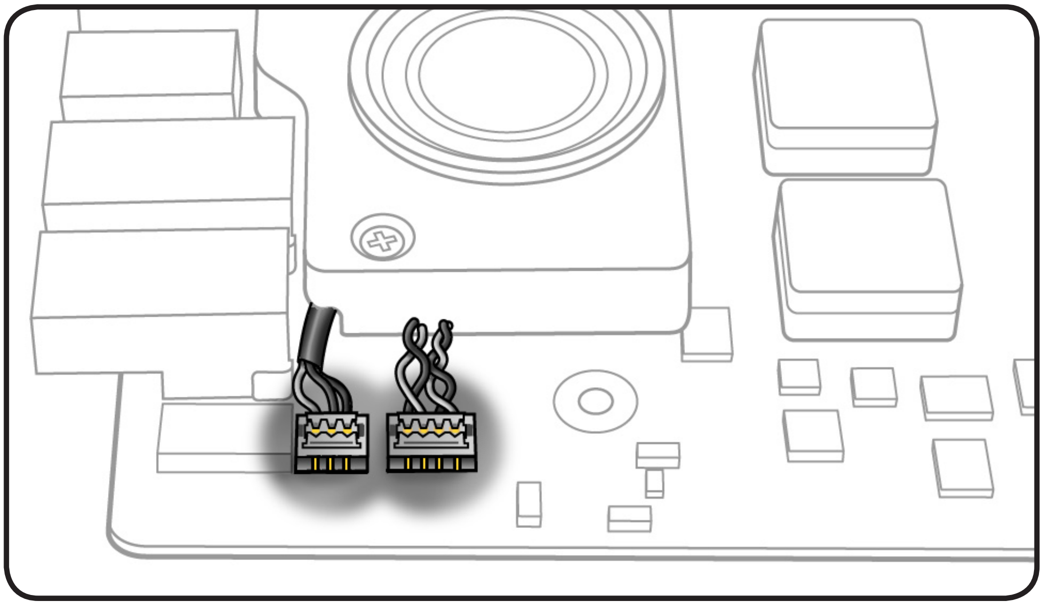


Removal

Note: Do not touch the soft speaker cone.

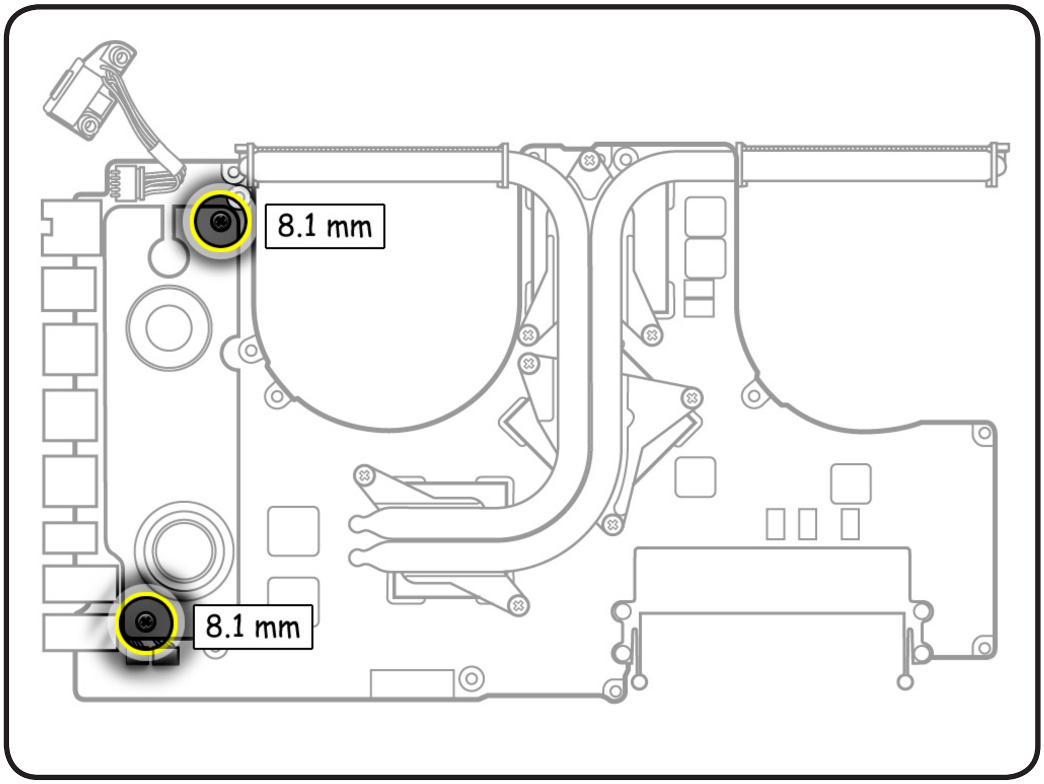
1 Disconnect 2 cables:

- microphone
- speaker



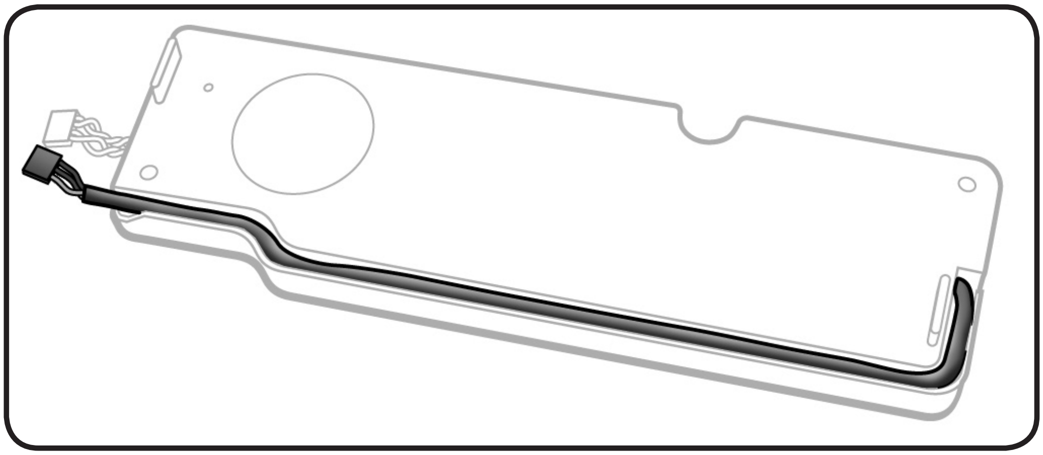
2 Remove 2 (8.1-mm) 922-8720 screws.

Replacement Note: If replacing the speaker, transfer microphone cable to replacement speaker.



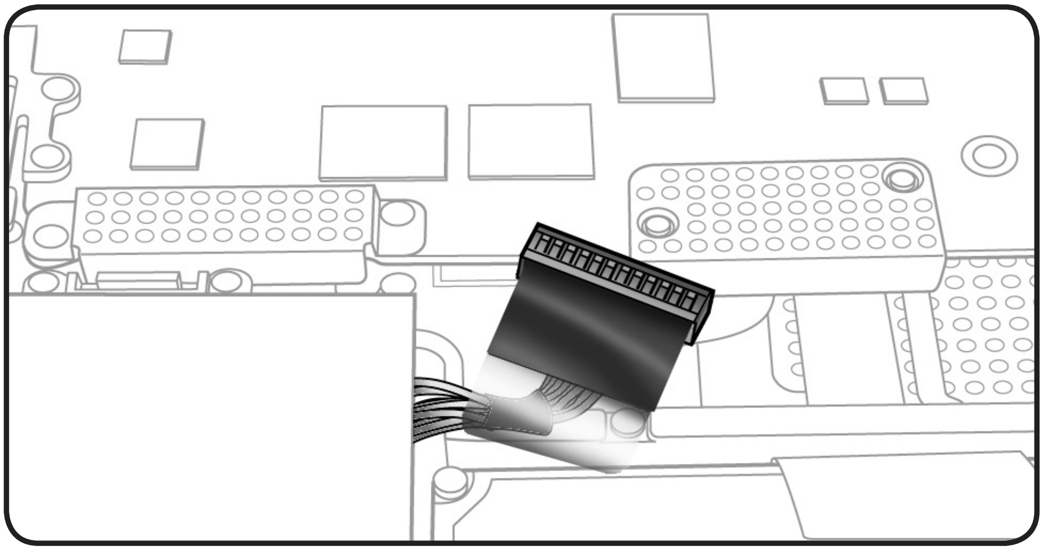
Microphone Cable

First Steps



Remove:

- Bottom case
- Memory
- Fans
- Logic board
- Left speaker



Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.

Tools

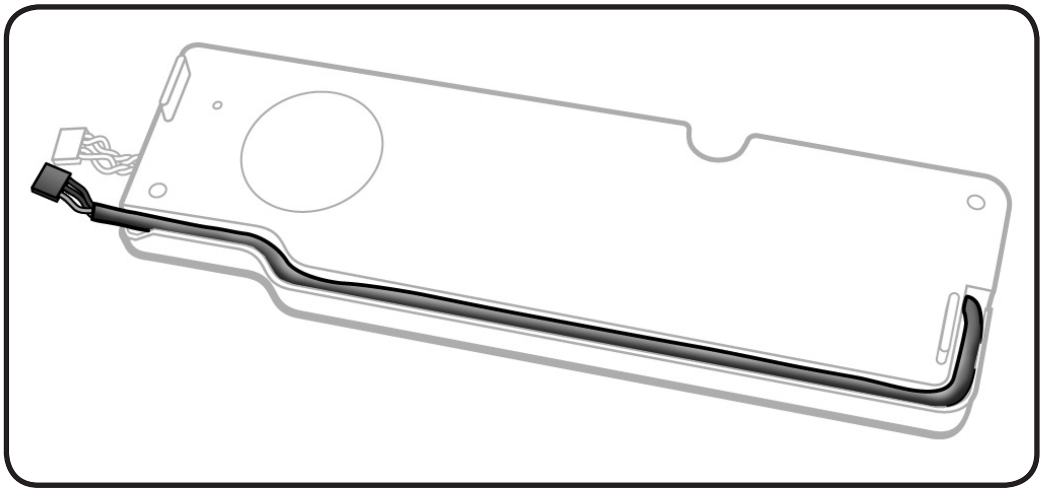
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick

Removal

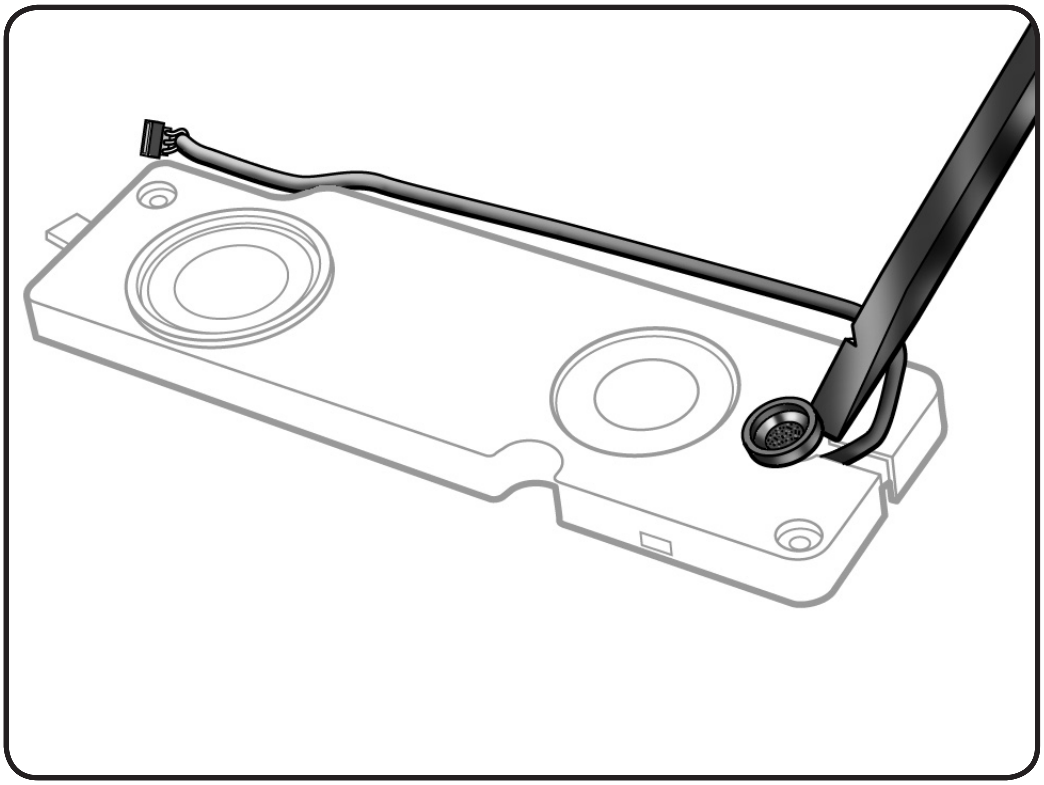
Note: Do not touch the soft speaker cone.

1 Unroute microphone cable.

Replacement Note: When transfering microphone cable to speaker, make sure cable is recessed within speaker body.



2 Turn over speaker, and carefully pry up the microphone gasket.

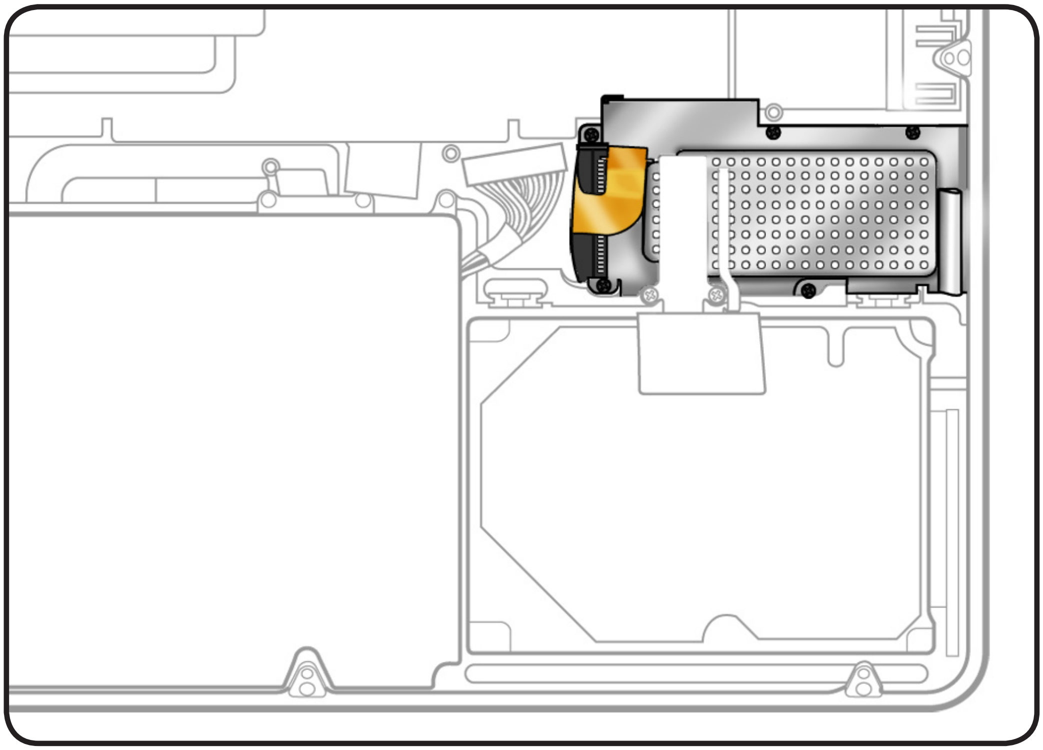


Express Card Cage

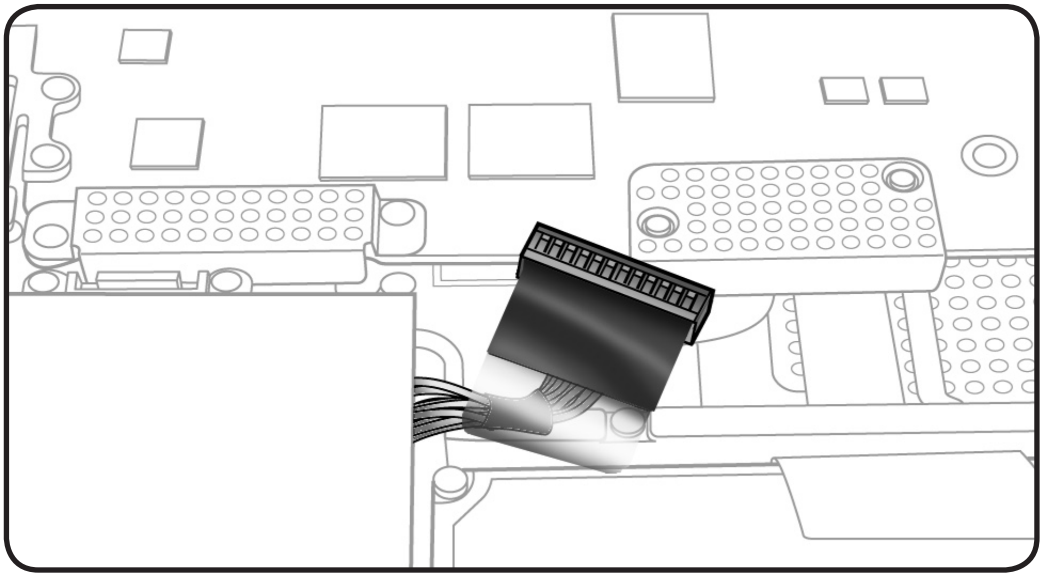
First Steps

Remove:

- **Bottom case**
- **Memory**
- **Fans**
- **Logic board**

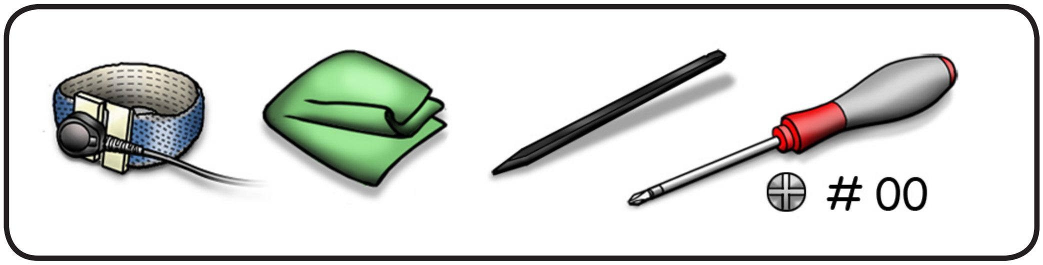


Before you begin this procedure, disconnect the battery from the logic board. Failure to do so could damage the computer.



Tools

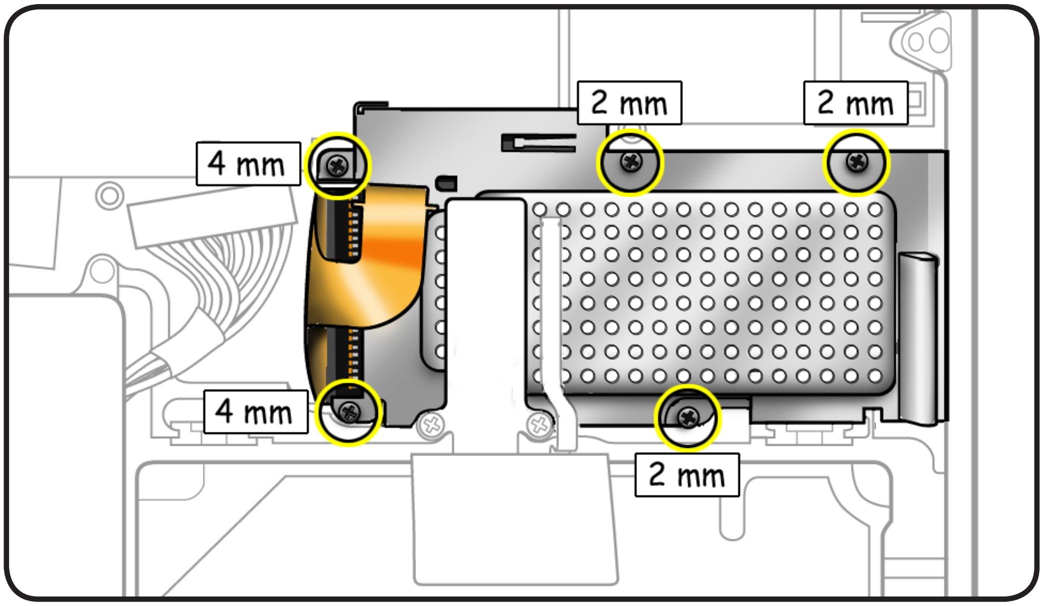
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



Removal

1 Remove 5 screws:

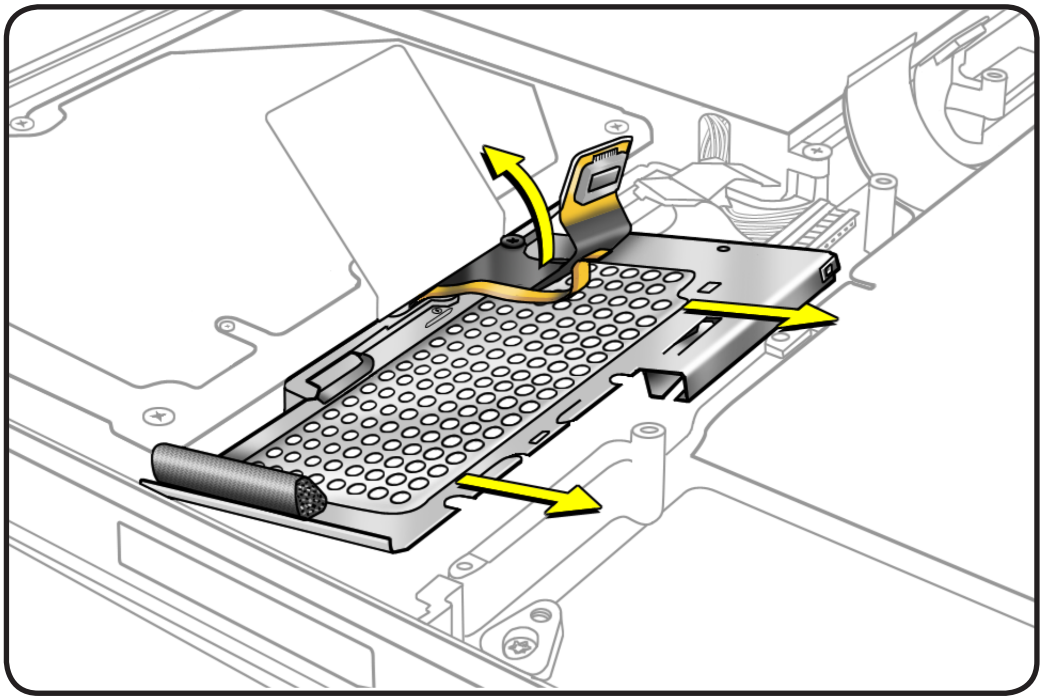
- 2 (4-mm) 922-8981
- 3 (2-mm) 922-8984



2 Carefully peel up flex cables from card cage.

3 Lift card cage from the top case.

Replacement Note: Carefully move aside flex cables to slide card cage into place.

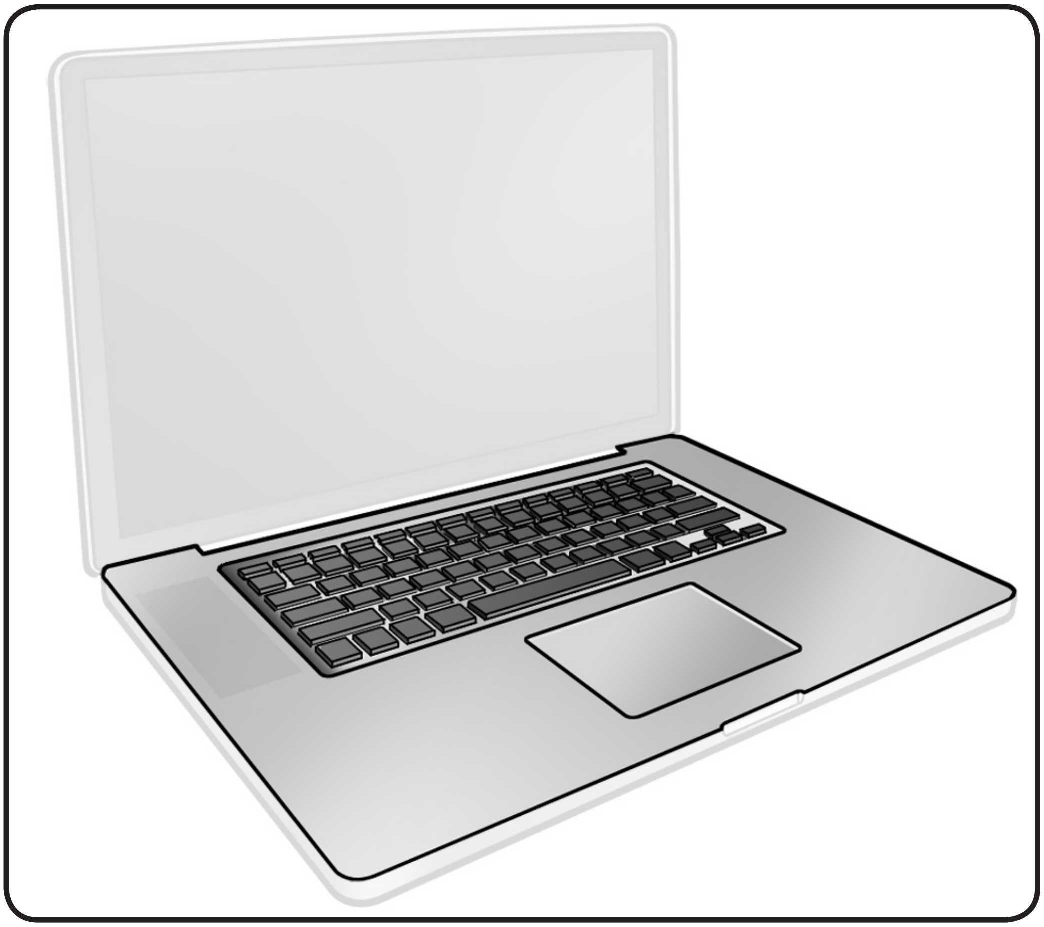


Top Case

First Steps

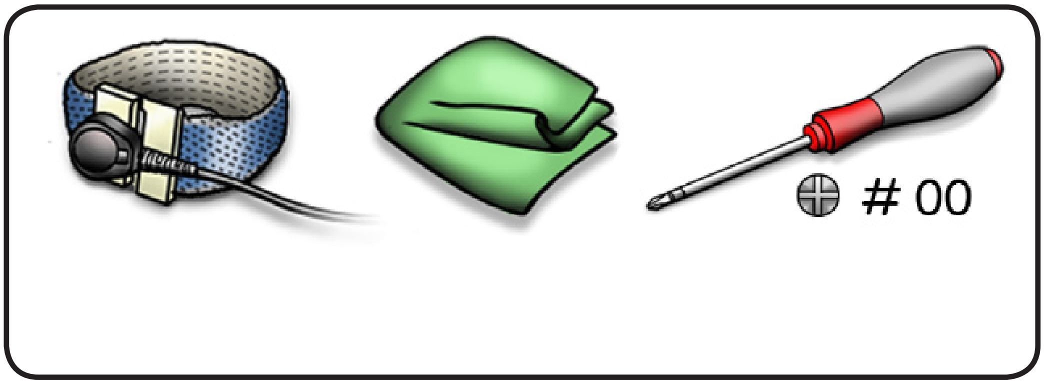
Remove:

- Bottom case
- Battery
- Hard drive bracket
- Hard drive
- Memory
- Camera cable guide
- LVDS cable guide
- Fans
- Optical drive
- Display assembly
- Right speaker/ subwoofer
- Logic board
- MagSafe board
- Express card cage

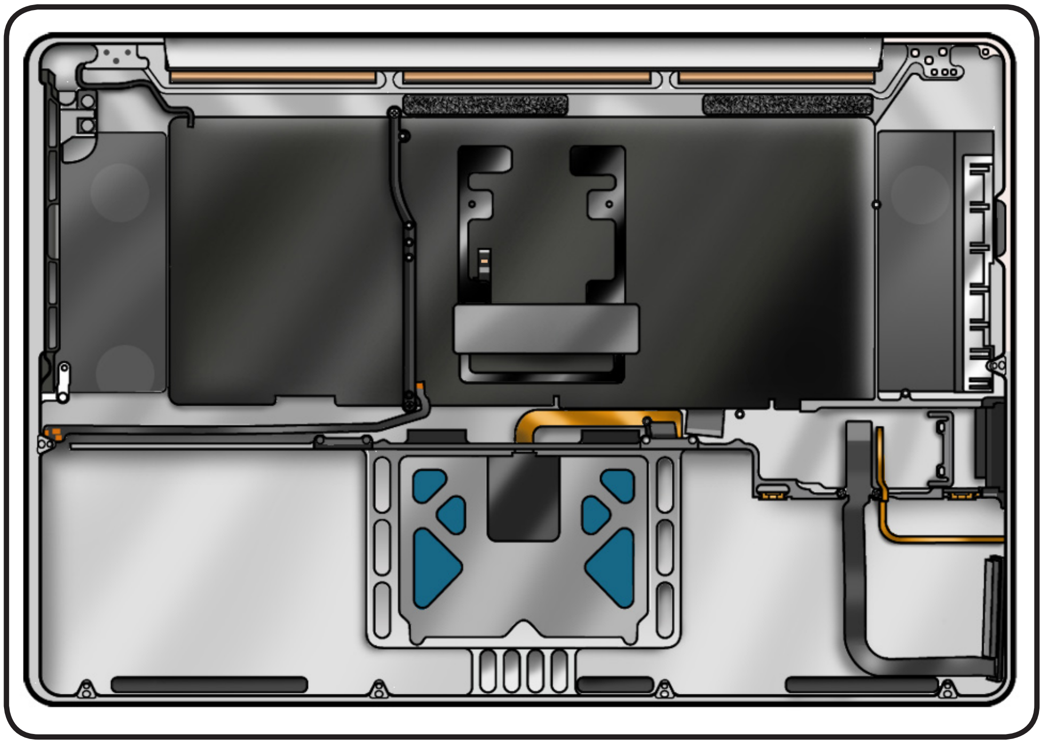


Tools

- Clean, soft, lint-free cloth
- ESD wrist strap
- Magnetized Phillips #00 screwdriver.



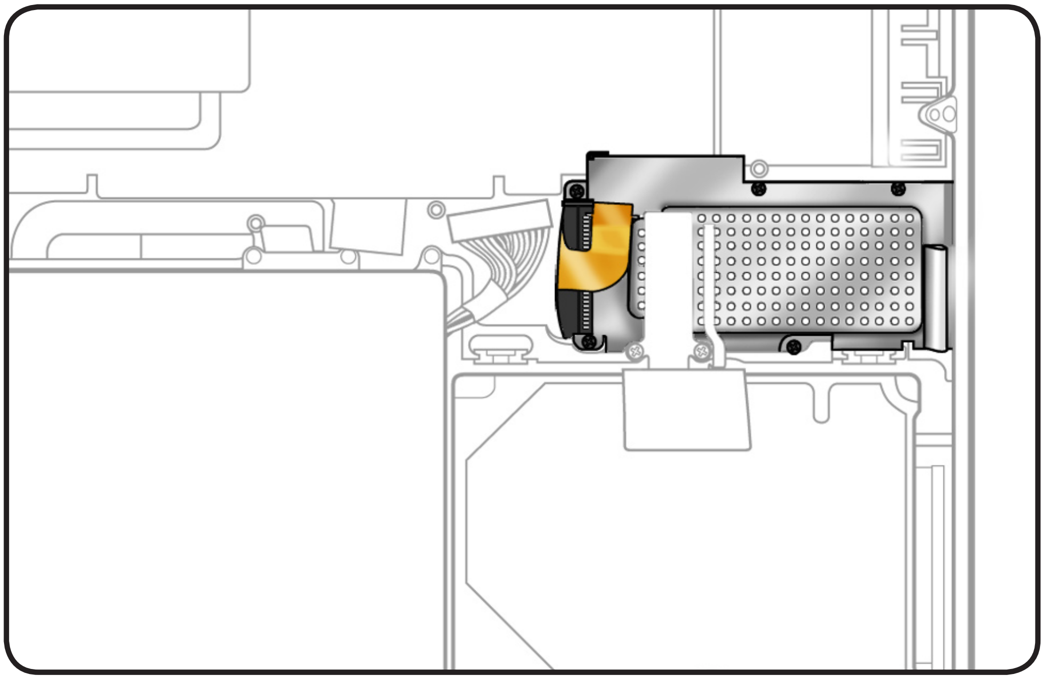
Removal



With the first steps completed, the top case with keyboard is the remaining part.

The top case includes:
- battery indicator light (BIL) board and cable
- hard drive connector cable
- IR/sleep indicator cable
- center bracket

Replacement Note: Before assembling the computer, be sure to first transfer the **Express card cage** to the new top case.



Apple Technician Guide

Views

MacBook Pro (17-inch, Early 2009)

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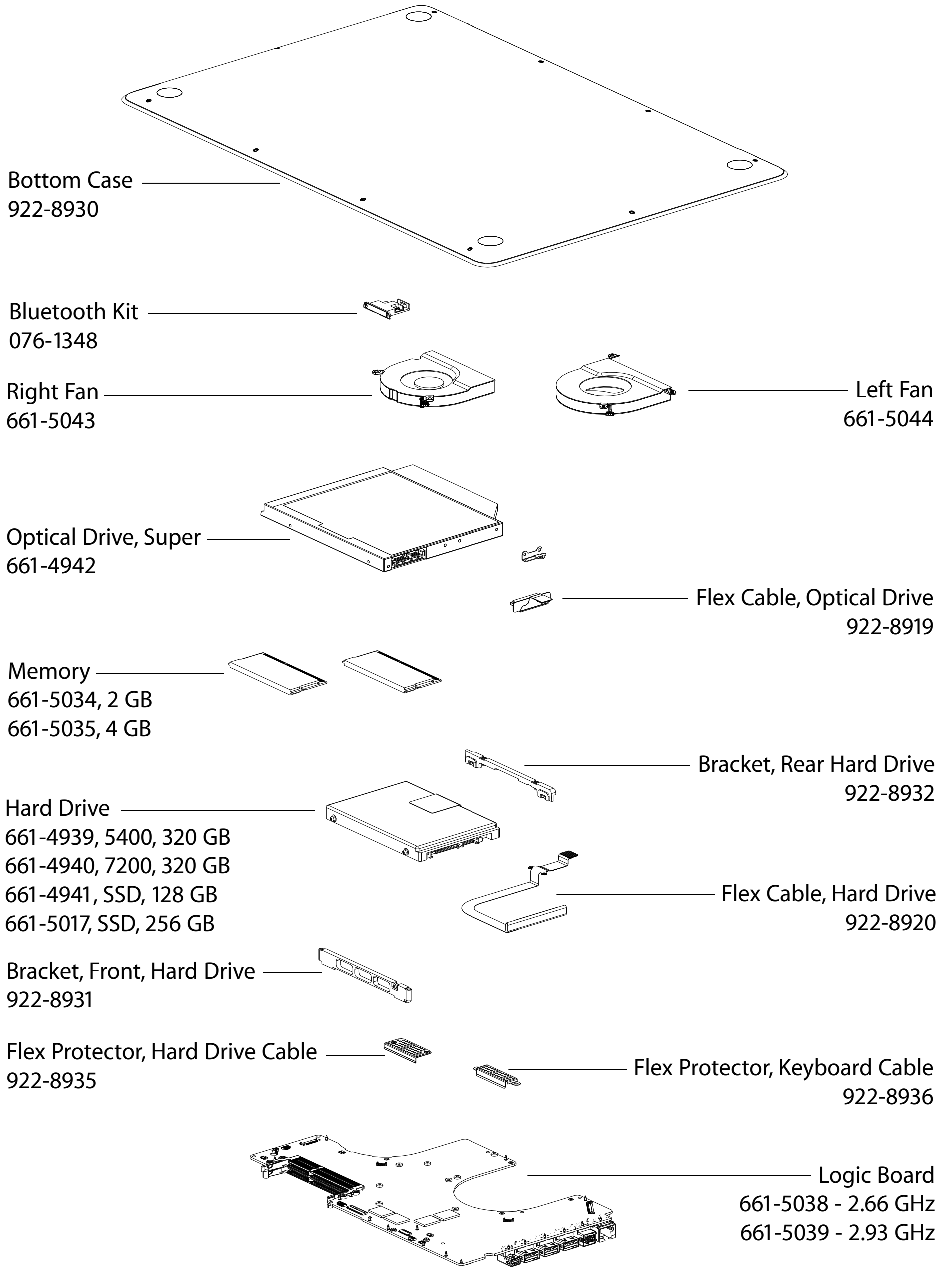
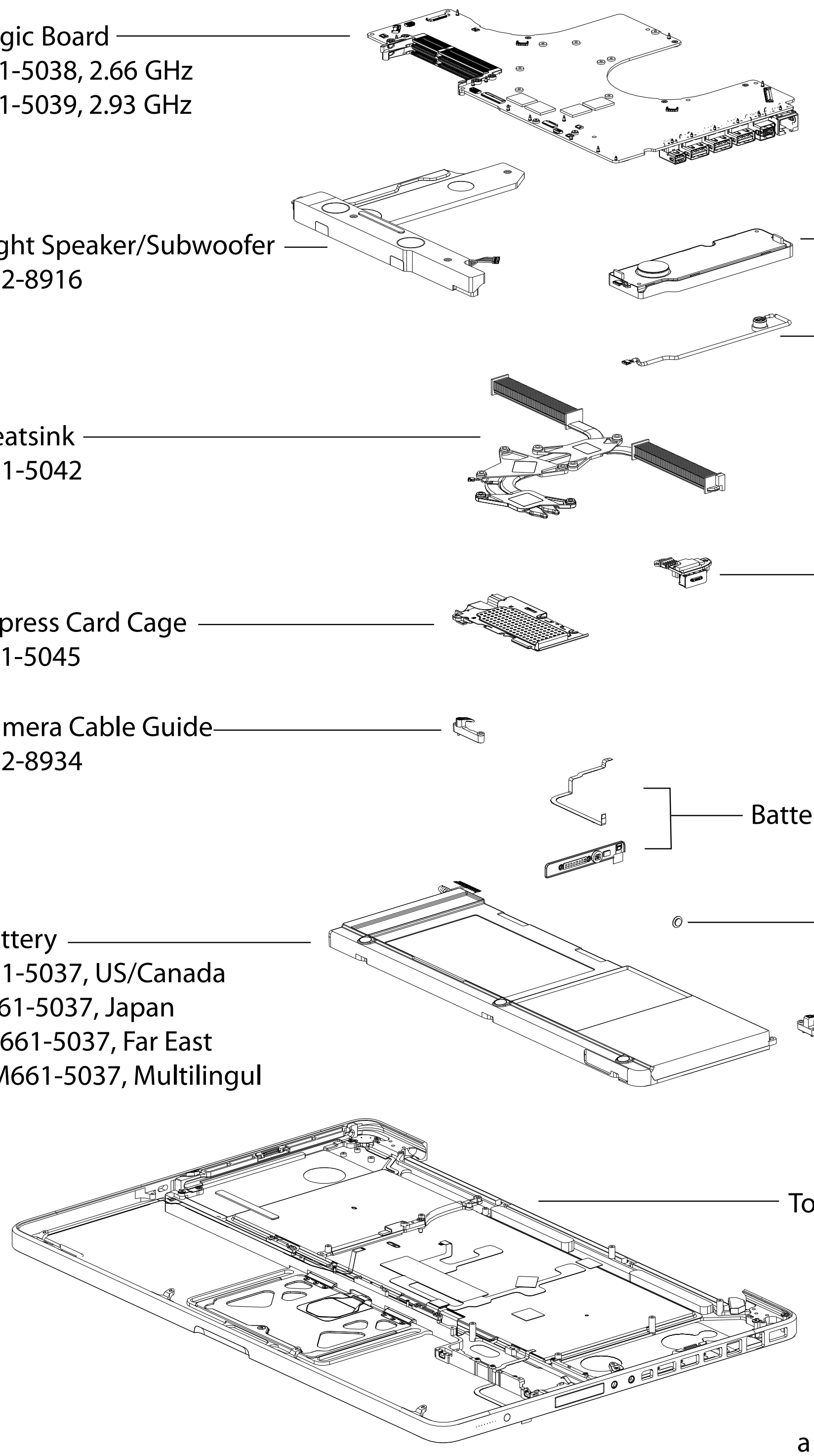
Exploded View

Main Assembly, 1 of 2


Bottom Case
922-8930
Bluetooth Kit
076-1348
Right Fan
661-5043
Left Fan
661-5044
Optical Drive, Super
661-4942
Flex Cable, Optical Drive
922-8919
Memory
661-5034, 2 GB
661-5035, 4 GB
Bracket, Rear Hard Drive
922-8932
Hard Drive
661-4939, 5400, 320 GB
661-4940, 7200, 320 GB
661-4941, SSD, 128 GB
661-5017, SSD, 256 GB
Flex Cable, Hard Drive
922-8920
Bracket, Front, Hard Drive
922-8931
Flex Protector, Hard Drive Cable
922-8935
Flex Protector, Keyboard Cable
922-8936
Logic Board
661-5038 - 2.66 GHz
661-5039 - 2.93 GHz

Main Assembly, 2 of 2



Logic Board
661-5038, 2.66 GHz
661-5039, 2.93 GHz

Right Speaker/Subwoofer
922-8916

Left Speaker
922-8917

Microphone
922-8918

Heatsink
661-5042

MagSafe Board
661-4950

Express Card Cage
661-5045

Camera Cable Guide
922-8934

Battery Indicator Light (BIL)
922-8921

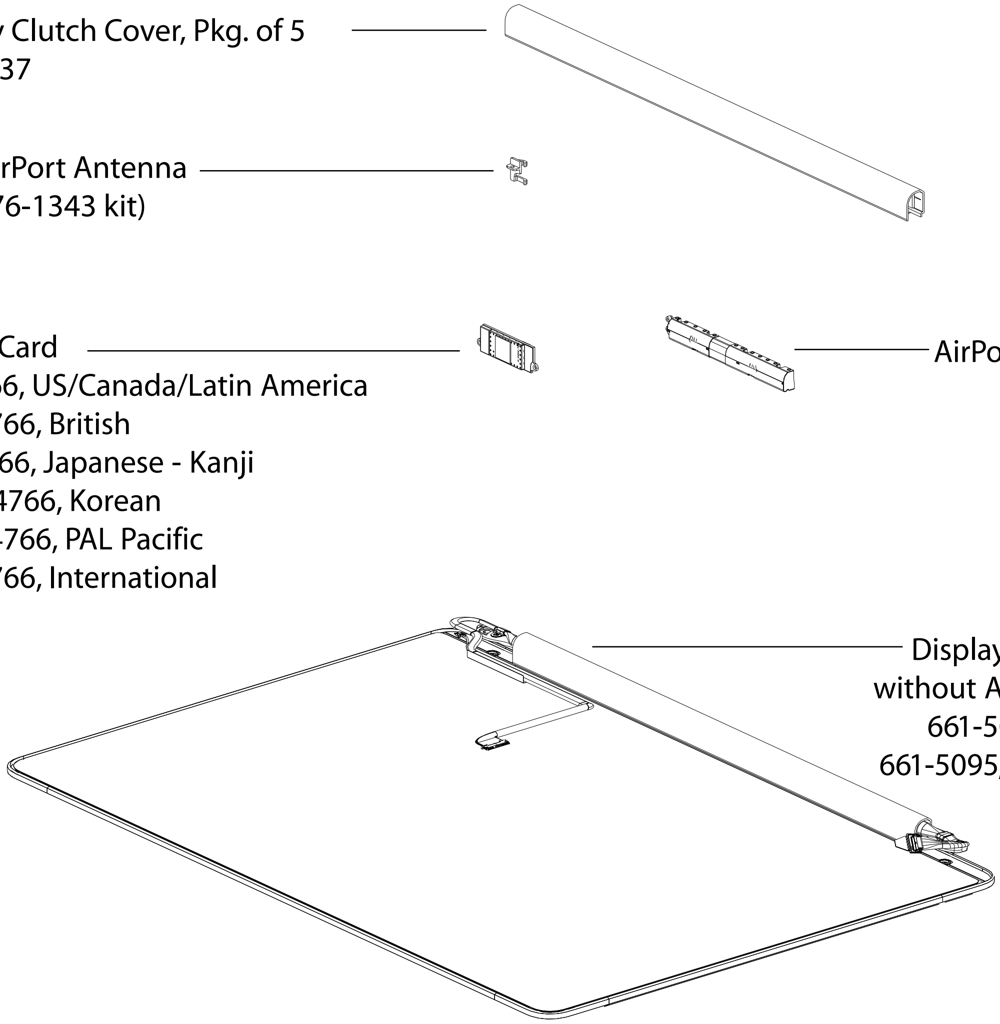
Button, BIL, Pkg of 5
922-8792

Battery
661-5037, US/Canada
J661-5037, Japan
FE661-5037, Far East
ZM661-5037, Multilingul

LVDS Cable Guide
922-8933

Top Case with Keyboard
661-5041, US
Note: Regional
top cases have
the same base
part number, but
they include
a language code prefix
(i.e. F661-5041 for French).

Display Assembly



Display Clutch Cover, Pkg. of 5
922-8937

Clip, AirPort Antenna
(in a 076-1343 kit)

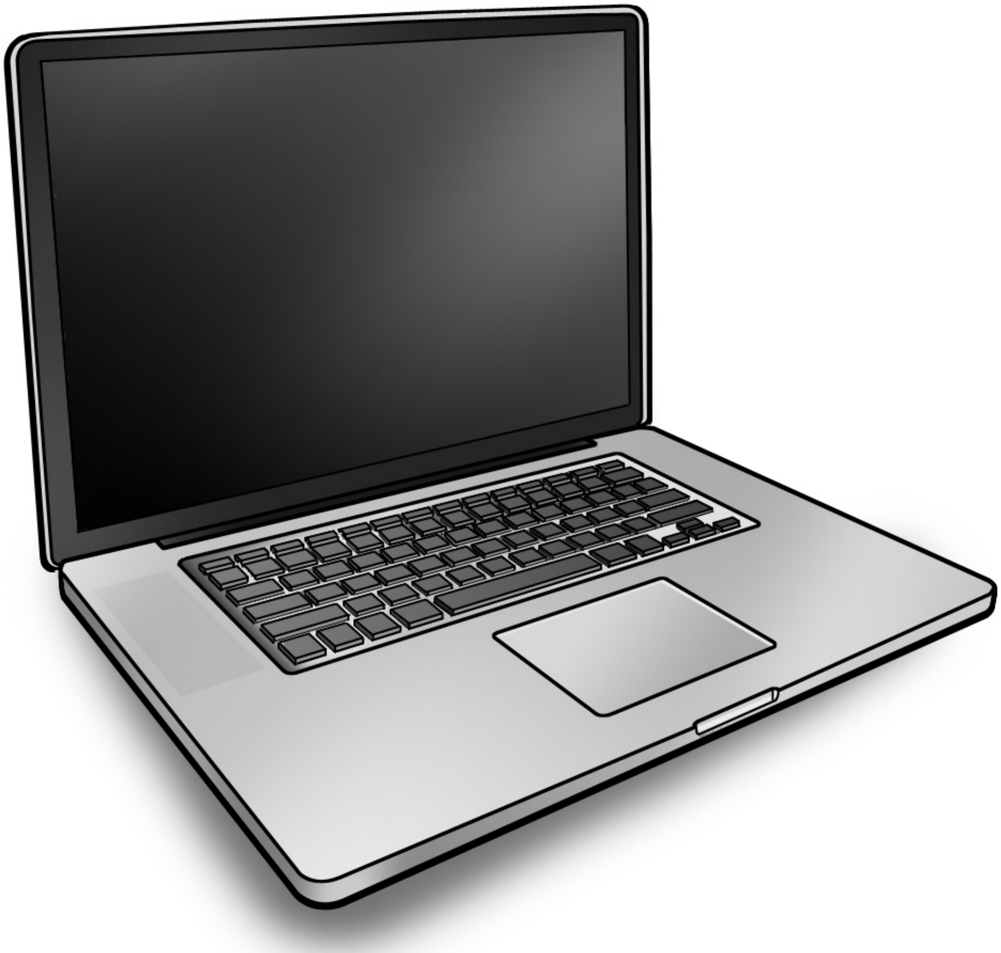
AirPort Card
661-4766, US/Canada/Latin America
B661-4766, British
J661-4766, Japanese - Kanji
KH661-4766, Korean
PA661-4766, PAL Pacific
Z661-4766, International

AirPort Antenna
922-8923

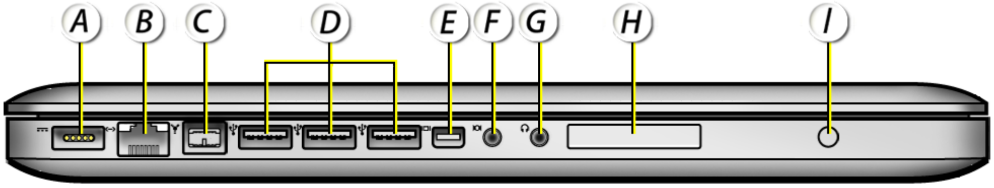
Display Assembly,
without AirPort Card
661-5040, Glossy
661-5095, Anti-Glare

External Views

Front View



Port View



A = MagSafe Power

B = Gigabit Ethernet

C = FireWire 800

D = USB 2.0 (3 high speed)

E = Mini DisplayPort (video out)

F = Audio In/Optical Digital Audio In

G = Headphone Out/Optical Digital Audio Out

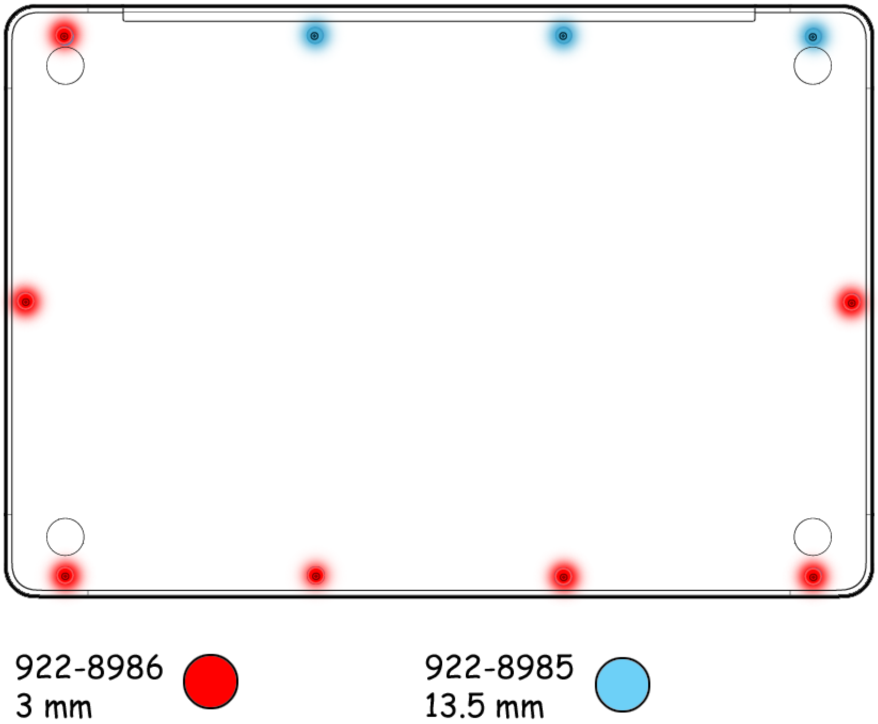
H = Express Card Slot (34mm)

I = Battery Indicator Light (BIL) Button

Screw Location Diagrams

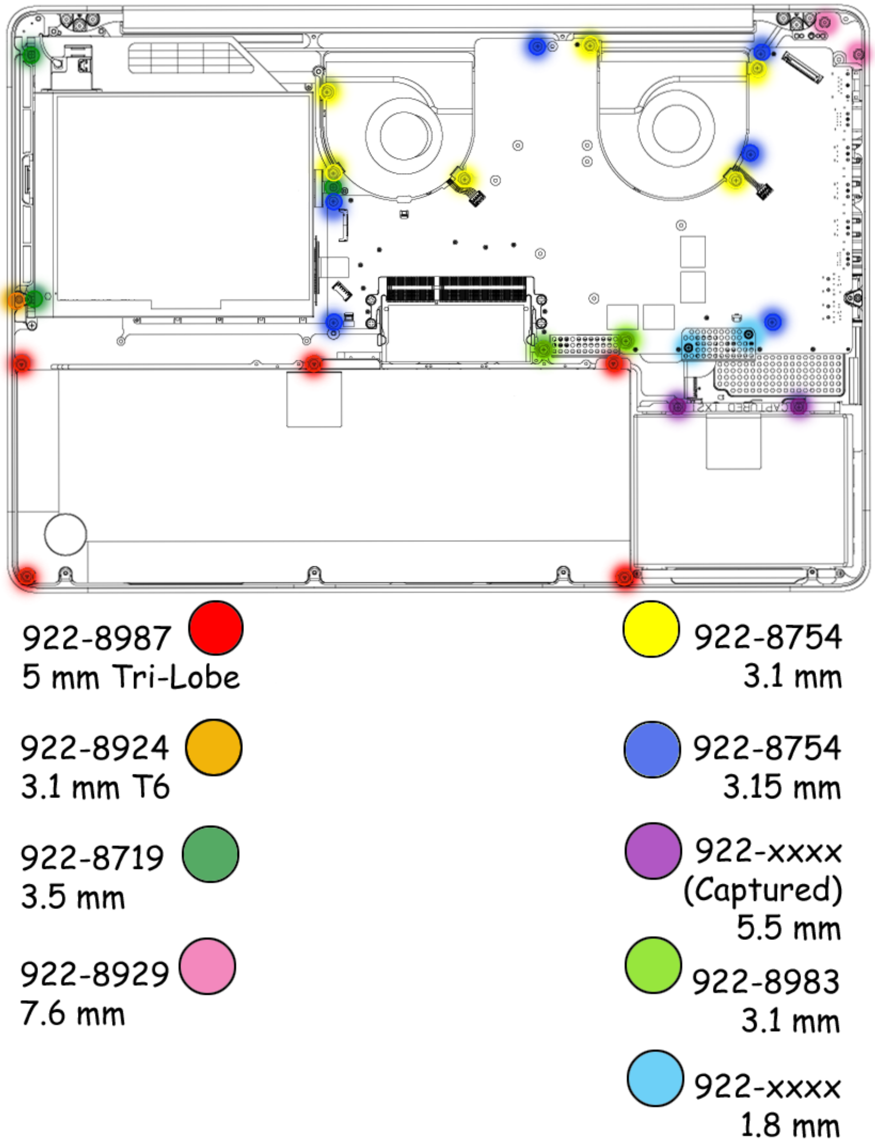
Bottom Case

All screw sizes shown are approximate and represent the total length of the screw.


922-8986
3 mm
922-8985
13.5 mm

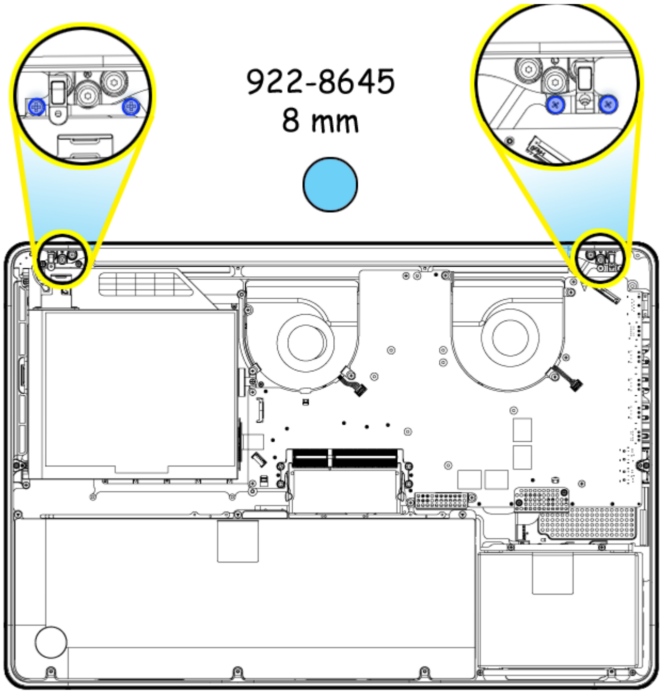
Main Modules

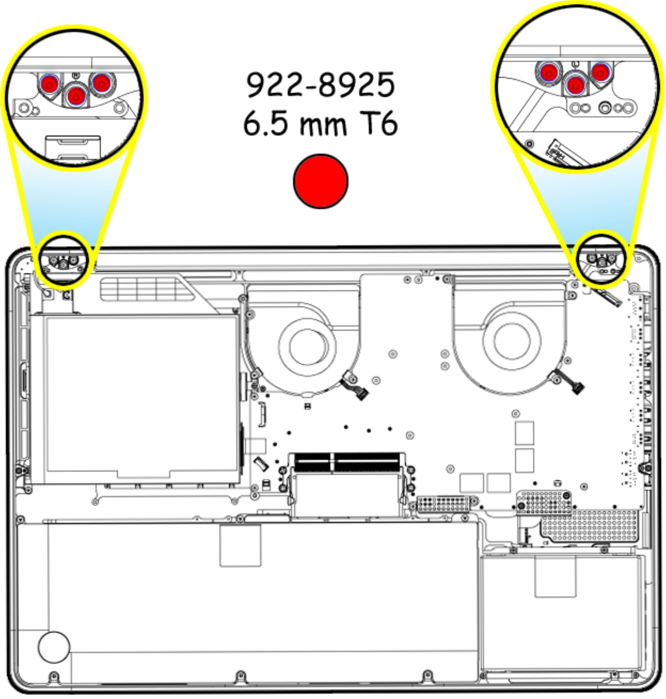
All screw sizes shown are approximate and represent the total length of the screw.


922-8987 🔴
5 mm Tri-Lobe
922-8924 🟠
3.1 mm T6
922-8719 🟢
3.5 mm
922-8929 ●
7.6 mm
🟡 922-8754
3.1 mm
🔵 922-8754
3.15 mm
🟣 922-xxxx
(Captured)
5.5 mm
🟢 922-8983
3.1 mm
🔵 922-xxxx
1.8 mm
CAPTURED 1X2

Display Assembly

All screw sizes shown are approximate and represent the total length of the screw.


922-8645
8 mm


922-8925
6.5 mm T6

Feedback

We want your feedback to help improve this and future Technician Guides!

Please email any comments to:

smfeedback4@apple.com